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BOOK DEPARTMENT

COLLEGE ARCHITECTURE IN AMERICA

A REVIEW BY

WALTER KNIGHT COLE

THE authors of this work on "College Architecture in America" give as its *raison d'etre* the statement: "There is no art in which this country has made more rapid strides than architecture, and our institutions of learning should exemplify this national progress, especially since it so effectively ministers to all other arts as well as to science and to daily life." Indeed it is not hard to understand that a lasting influence can be brought to bear on the whole future lives of students in institutions of learning by surrounding them with scenes of real natural beauty and architectural character. Such students are usually at an impressionable period of their lives, and it is during this period that much of their taste for art and literature, whether it be good or bad, will be formed. Added to this are purely practical considerations having to do with the advertising of the institution. The colleges of the country have come to realize that in order to remain popular in the face of so much competition as now exists it is necessary to adopt some of the advertising tactics commonly employed to keep certain commercial products in the public eye, and good architecture does this well.

Music Building, Smith College
Delano & Aldrich, Architects

While the more sensational method of college advertising consists largely in the assembling and developing of successful athletic teams, a much more lasting and dignified means of attracting public interest is by presenting an exterior appearance of true æsthetic and architectural worth, embodying something of the dignity and character of the institution that occupies the buildings. The fact that good architecture is one of the best advertising media in existence has long been well known to the leaders of industry. It is said that in the period immediately following the erection of the Woolworth Building in New York, the Woolworth organization experienced a tremendous expansion throughout the entire country. Although it is possible for but few to write their names at the topmost point of the Manhattan skyline, many have succeeded in gaining much desirable publicity through housing their offices or plants in buildings having distinguished or unique architectural character, a good example of the latter being the American Radiator Building. The same principle applies in the matter of presenting the merits of a particular institution of learning to public attention. Since the contact of a vast majority of persons with colleges consists solely of a passing view or an excursion through the buildings, the importance of an attractive exterior is evident. If the institution greets the eye with a medley of dreary, obsolete structures the impression gained is naturally not at all favorable, whereas, on the other hand, a well ordered college campus with beautiful, dignified academic structures excites popular admiration and gains for the institution a feeling of respect which would be hard to impart in any other manner likely to be adopted.

Another matter contributing to the importance of having good architecture in college buildings is the fact that the buildings form the only really tangible part of the institution and are most important in maintaining contacts between the graduates and their alma mater. The personnel of a college changes rapidly, and new faces replace the old, but beautiful old buildings remain throughout the years to greet the returning alumni and bring back memories of bygone days. For all these reasons it is important that the problem of laying out a new college or adding new buildings to the plant of an old institution should be given a great amount of study. The buildings differ from those used for commercial purposes in that they will in all probability be in use for several centuries, whereas the average life of a commercial structure extends only over a few decades at the most. Therefore college buildings must be planned with a view to great permanence and as far as possible to meet the changing needs and conditions that are likely to arise throughout years to come. Their planning must take into consideration a vast number of controlling factors, such as the traditions of the school and the type and topography of the site as well as the kind of instruction to be given; as already said, provision should always be made for future growth and changing needs, and due regard be paid to the character of the student body which is to use the buildings.

The present era has been marked by a greatly increased tendency on the part of large numbers of young people to seek higher education, so that there has been an unprecedented rush of students to colleges and universities throughout the country. The older institutions have had to add greatly to their physical equipment, and an unbelievable number of brand new colleges have been

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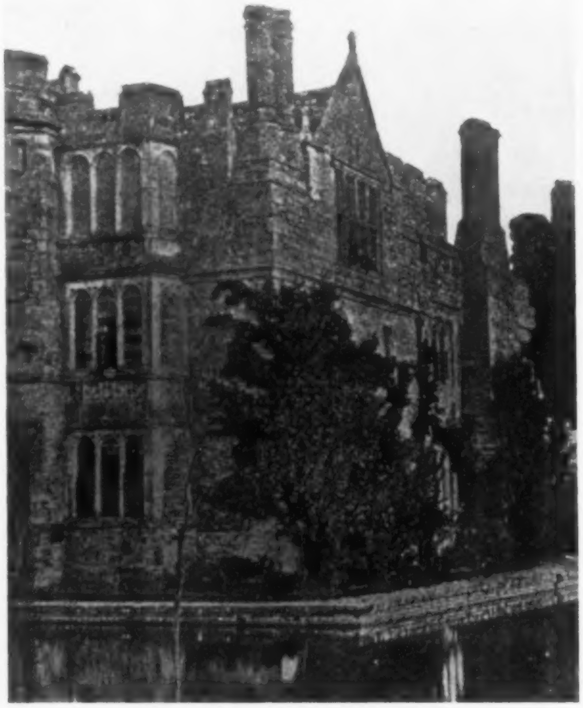
By Thomas Garner *and* Arthur Stratton

A New, Larger, and Better Edition of an Architectural Classic



Hever Castle, Kent.

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¶ A new, enlarged and improved edition of this important work overcomes these objections. The page size of the volumes has been considerably reduced, their contents much enlarged, and the additions to the subject matter deal largely with work of the simpler, more moderate character which is adaptable to use in America today. The two volumes abound in illustrations of exteriors and interiors of domestic buildings, and these illustrations are supplemented by countless drawings of details,—half-timber work; chimneys; wall paneling; doors; door and window surrounds; mantels and chimneypieces; ceilings; stairways; interior vestibules, and the other details which mean so much to the designer and aid so powerfully in creating the atmosphere belonging to these English styles.

2 volumes; 237 pp. and 210 plates; 12 x 15 ins.

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springing up. In the past it has been too often the case in the construction of college buildings that the money spent has been wasted on structures which are not only unsightly but impractical and poorly suited to the requirements of utility, with the result that our campuses are dotted with buildings which the authors of the present work describe as a "blot upon the scene that evokes the unholy impulse in some secret breast to pray for a fire." Most of these buildings, it is true, were constructed during the dark ages of American architecture. Many of the early college buildings were extremely fine examples and include such masterpieces as the structures designed by Thomas Jefferson for the University of Virginia, and Philip Hooker's Hamilton College Chapel, and the earliest college building in America, built at William and Mary College after designs by Wren. At Dickinson College the old West College building was designed by Benjamin Latrobe, and at Rutgers the Queens Building was the work of John McComb, Jr. The way in which these fine old examples have endured to glorify the names of their designers should inspire present-day architects to strive to perpetuate the ideals of present-day architecture in work that is so likely to be enduring and therefore of such great importance.

Since orderliness is the first requisite of all art as well as of education, this is one of the most desirable qualities to be embodied in a group of college buildings, not only for the effect it has upon the developing minds of the students, but for the pleasing appearance it imparts to the general scene. Architectural confusion detracts more from the beauty of American cities than any other single factor and is a phase of architecture that should receive much more serious consideration. In the field of college architecture a great deal has recently been accomplished in the way of preparing preliminary comprehensive plans for the layout and development of college groups. It may be said that Thomas Jefferson was the first to prepare a well ordered general development plan by laying out a complete group of buildings for the University of Virginia. The idea was not generally followed, however, and for a long period colleges were allowed to develop along haphazard lines by adding buildings from time to time as the need was felt. The practice of orderly planning was revived and given new impetus by the complete designs for Stanford University by Shepley, Rutan & Coolidge. Since that time it is likely that practically every college in the country has obtained for itself some sort of prospective plan for the future layout of its buildings. Since it is such a difficult task to foretell accurately what the future needs and conditions will be, these general development plans are adopted in principle only and are subject to change at any future time. They do, however, furnish a definite basis on which to proceed and help greatly in solving the problem of combining the teaching, housing and recreational facilities in one group of buildings. The æsthetic advantages arising from the use of such a general development plan are incalculable, since in this way each structure is made to harmonize with the others, and the entire group is given the quality of orderliness, whether the plan adopted be formal or informal and rambling, according to site and conditions.

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the part of the authors, who visited over 70 institutions personally and spent much time in writing for and receiving information from those they were unable to visit personally. Their positions as leading architects of college buildings make them particularly well fitted for the task of bringing together all available information, and it is felt that they have contributed something really worth while to the field of college architecture. There are 217 illustrations from plans and photographs, and the text discussion of the various classes of buildings is very complete. The more notable examples of old college structures are shown, and the story of college architecture from the beginning is well told. The general principles and controlling factors in relation to college buildings are discussed and give an idea as to the way in which the problem of college planning should be approached. The important subject of general development plans is also well covered by illustrations and text descriptions. The various classes of buildings are then treated separately, each in a chapter of its own. Administrative office buildings form the nerve centers about which a college or university functions, and they should be planned so as to centralize all departments in as efficient a manner as possible. The authors, under this heading, discuss the administrative buildings in many colleges, pointing out their advantages and disadvantages by the use of illustrations and floor plans. The structures to be used for academic purposes exclusively form another important class of buildings, and the laying out of classrooms and special departments is of great importance to the proper functioning of the educational department. Here again much careful consideration must be given to probable future conditions and provision be made for possible expansion. A wide variety of such buildings ranging from the skyscraper school of commerce at Northwestern University, to the small building housing the law school at Emory University are shown.

The library is, as the authors describe it, "the intellectual power plant of the college or university; it is related to all departments and it must keep pace with all departments in supplying to each branch of study the books and references needed. Hence it must be sensitive to the expansion of any teaching unit of the university." The designing of libraries is a highly specialized field of architecture, and the examples shown and discussed here present a good idea as to how the library should be adapted to the needs of a school or college. In chapels and auditoriums the inspirational value of fine architecture has perhaps its greatest effect. Such buildings are of a more monumental nature, and in their design the architect is not so rigidly bound by the requirements of utility. In this chapter we find illustrated such noted examples as the Hamilton College Chapel, built in 1828 from a design by Philip Hooker, the chapel at West Point by Cram, Goodhue & Ferguson, and many other beautiful structures. The widely varied types of buildings which go to furnish living and recreational facilities are discussed and illustrated in the several chapters which follow, and include dormitories separated under two headings,—those for men and those for women; dining halls and cafeterias; engineering and central heating plants; art buildings and museums; and structures such as gymnasiums for athletics as well as buildings devoted to all forms of student and faculty welfare.

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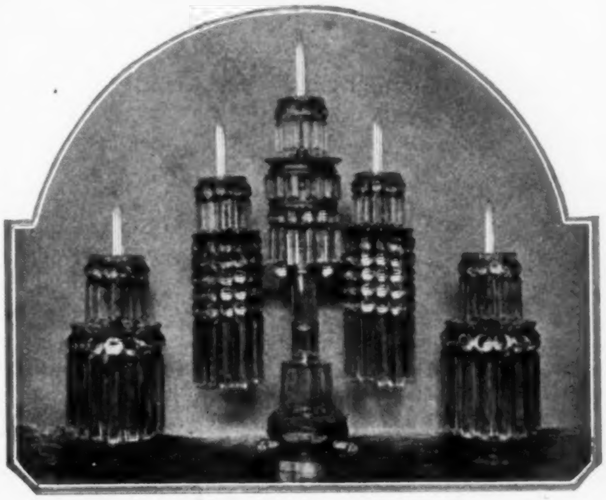

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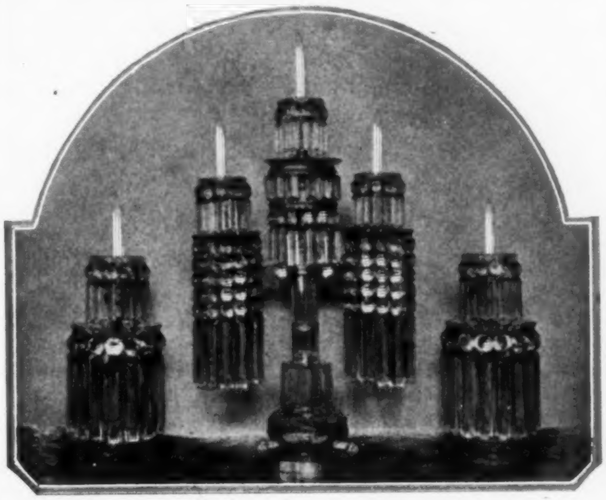

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Of great practical value to the architect about to engage on a commission involving college buildings will be the two final chapters, one on "Sundry Important Considerations," and the other dealing with actual "Building Operations." A complete college plant combines in itself so many diversified functions that the study of their planning covers an extremely broad field of architectural knowledge of which the present carefully prepared volume is a very complete and well considered digest.

COLLEGE ARCHITECTURE IN AMERICA. By Charles Z. Klauder and Herbert C. Wise. 301 pp. 7½ x 10 ins. Price $5. Special net. Charles Scribner's Sons, 597 Fifth Ave., New York.

THE STEEL SQUARE POCKET BOOK. By Dwight L. Stoddard. 181 pp. 3¾ x 5¾ ins. Price $1. Scientific Book Corporation, 15 East 26th Street, New York.

THE issuing of a manual in a fourth edition should certainly be convincing proof of its value to those for whom it was prepared. Mr. Stoddard says, to quote the preface to this edition: "More than 30 years ago, to answer a correspondent, I wrote a short article on the square for *Carpentry and Building*, now *The Building Age*. Since then I have been asked to write articles on the subject, and many have been printed by magazines.

"Carpenters then requested me to put these articles into book form, but as so much had been written on the subject, I doubted the need for a new book. However, I found that little was available in plain and practical language, with illustrations to suit, for the carpenter and mechanic. It is 24 years since the first edition of this work appeared. The demand has been so satisfactory that three revisions and enlargements were justified. The original idea, that of a convenient and handy reference on the use of the square, has been adhered to throughout. It is not possible in this small book to tell of all of the possibilities of the square, but a great deal will be found on the use of this tool or calculating appliance which answers almost at once nearly every problem that comes before the practical carpenter.

"An important feature of the illustrations is the absence of reference letters. Instead, an exact engraving is given of the square itself laid on the work and showing all points, lengths, and quantities sought. This eliminates the reading of long descriptions, because in many cases the illustration shows the solution of the problem. This feature should commend itself to all carpenters.

"The numbers that appear at the beginning of the paragraphs throughout the book indicate the number of the problem of which the paragraph treats and corresponds with the illustration bearing the same number."

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THE improvement which has accompanied the progress of American architecture during recent years has been no more marked in any department than in that of an ecclesiastical nature. This has been due primarily to the rise of a few architects who by travel and study have acquired much of the point of view from which worked the builders of the beautiful structures which during the fourteenth century and the fifteenth were being built over all of Europe.

These architects have closely studied the churches, chapels, convents and other similar buildings in England, France, Spain and elsewhere, and the result has been a number of American churches of an excellence so marked that they have influenced ecclesiastical architecture in general and have led a distinct advance toward a vastly better standard. This improvement has not been exclusively in the matter of design, for plans of older buildings have been adapted to present-day needs, and old forms have been applied to purposes which are wholly new.

THE appearance of a new and revised edition of a work which is by far the best in its field records this progress. Mr. Cram, being perhaps the leader among the architects who have led this advance, is himself the one individual best qualified to write regarding the betterment of ecclesiastical architecture. The editions of this work of 1900 and 1914, which have for some time been out of print, have now been considerably revised and much entirely new matter has been added, which in view of the change which has come over ecclesiastical building of every nature is both significant and helpful.

Illustrations used in this new edition of "Church Building" show the best of recent work—views of churches and chapels large and small, in town and country, buildings rich in material and design and others plain to the point of severity, with the sole ornament in the use of fine proportions and correct lines. Part of the work deals with the accessories of the churches and their worship.

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THE EDITOR'S FORUM

A DISTINCTIVE AMERICAN ARCHITECTURE

CHICAGO'S towers and Manhattan's cliffs of masonry are the forerunners of a distinctive American architecture, Louis La Beaume of St. Louis, a director of the American Institute of Architects, declares. America has completed that period of its history when it was not only a melting pot for many races but a museum of the architecture of many lands. Mr. La Beaume predicts that our architects will lay aside historical patterns for buildings and will develop a style of architecture corresponding to the swift tempo of our existence.

"If many races have been fused in the making of America, the architecture of many races has been transplanted, if not fused, to safeguard the American citizen against homesickness for the scenes of his ancestors. Greece, Rome, the Italy of the Medicis, the France of every dynasty from Charlemagne to Poincaire, the England of 800 years from William the Conqueror to George V, the Spain of the Moors, of Ferdinand and Isabella, and the four Philips, have been copied. A diligent student may make the equivalent of the grand tour of Europe and familiarize himself with the culture of a dozen races throughout a period 2,000 years without a passport,—without even a twinge of seasickness. This is the architecture of America, but what of American architecture? What do our flattering critics mean when they proclaim that we lead the world in this most vital of all the arts? Do they mean that our Georgian houses are better than Georgian houses ever were, that our Normandy manors are more redolent of Normandy, our Cotswold cottages more utterly charming, or our Spanish farmhouses more typically Spanish than their prototypes? No, they cannot mean this. They must mean something else. Our Gothic churches cannot be better than the Gothic of the Ile de France, our temples, or rather our templed memorials, or counting houses, cannot exceed the perfection of the Parthenon. They must see in our factories, in our skyscrapers, something they have never seen before; something must have suffered a sea change.

"We know that vastness and bulk, volume and height are attributes to conjure with. We know that those things cause the beholder to draw his breath,—almost make his reason totter. We have had some practice in managing them, which less prosperous, less dauntless people have not enjoyed. And yet in the very handling of these American masses are we not still straining our eyes toward Europe for suggestion? We talk now of modernism, we speak with disdain of the past of yesterday, and there is health in this, but let us be humble for a while, until we can be quite sure that the modernism we strive for is inherent in our own character. To borrow it from Sweden, from Germany, from Holland or from France would be but to continue our incorrigible habits of plagiarism. As moderns, we need offer no apology for being modern. It may be our misfortune, but it can hardly be said to be our fault. We were born too late to be anything else, and it is really to our credit that we are more willing each day to admit the dreadful fact. We share our modernism, too, with our contemporaries the world over. If our old stodgy habits are changing, if we are beginning to detect a new crispness and terseness, a new simplicity and directness in the design of our small as well as of our large buildings, we may seek for the cause in two factors. First, we are living in a crisper, speedier, smarter time; and, second, client and architect are more nearly one and the same than they ever were before.

"The young architect of today feels and reflects the tempo of his generation. As in dress, for instance, and feminine dress particularly, yards and yards of hampering fabric which an outworn tradition had sanctified, have been stripped off; as manners and music, and even morals, are tending more to the point each decade,—each year almost,—so our architecture is stripping itself of much of the historic impedimenta which clog and hamper its natural purpose. Climate and war and the worship of God, trade and the lust of gold, the struggle for power, the struggle for liberty, and fire, these things have all affected the architectural panorama. Which, most of all, it is difficult to say. The mediævalists might say the love of God; the classicists the love of liberty. War opened the path of the Renaissance into France; the great fire of London cleared the way for it in England. The love of gold, and again the love of liberty, lured men across the ocean. Perhaps in some cities of the United States fire has done more for civilization and architecture than any other single force. Fire can of course be a great blessing.

"Architecture is an art which, above all others, is founded on realism, on sincerity. Our past history might indicate that we have been rather flippant in our attitude toward it. Art is something more than the feather in an Alpine hat or the gold braid of an admiral's sleeve. If we are to regard modernism as just another fashion to be played with, as something that is going to be the rage like all the other rages, we will continue to be fashion mongers rather than architects, false to our opportunities and our obligations. As a plagiarist with a bad conscience but at the same time with an earnest desire to reform, I would say that the American architect should have full faith in the essential virtues of the American character, and that he should 'be himself.' "

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Cover Design: A Study in Red and Green
From an Oil Painting by Percival Goodman

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"Block House," Stanwich, Conn. — *Frontispiece*
From an Oil Sketch by Frank A. Wallis

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View of the Fuller Building, New York — *Frontispiece*
From a Photograph by George H. Van Anda

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PARKER MORSE HOOPER, A.I.A., Editor
KENNETH K. STOWELL, A.I.A., Associate Editor
Contributing Editors:
Harvey Wiley Corbett; Aymar Embury II; Charles G. Loring; Rexford Newcomb; C. Stanley Taylor; Alexander B. Trowbridge
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FLOOD IN BANK

....rips linoleum from floor tears veneer from table....

TELESCO PARTITION PRACTICALLY UNSCATHED

A FEW weeks ago, on a Sunday, a bursting water main precipitated tons of water into the Director's Room in the Bank of Yorktown, New York City. For practically an entire day the room stood in 2 feet of water. After the water was pumped out, here is what they found:

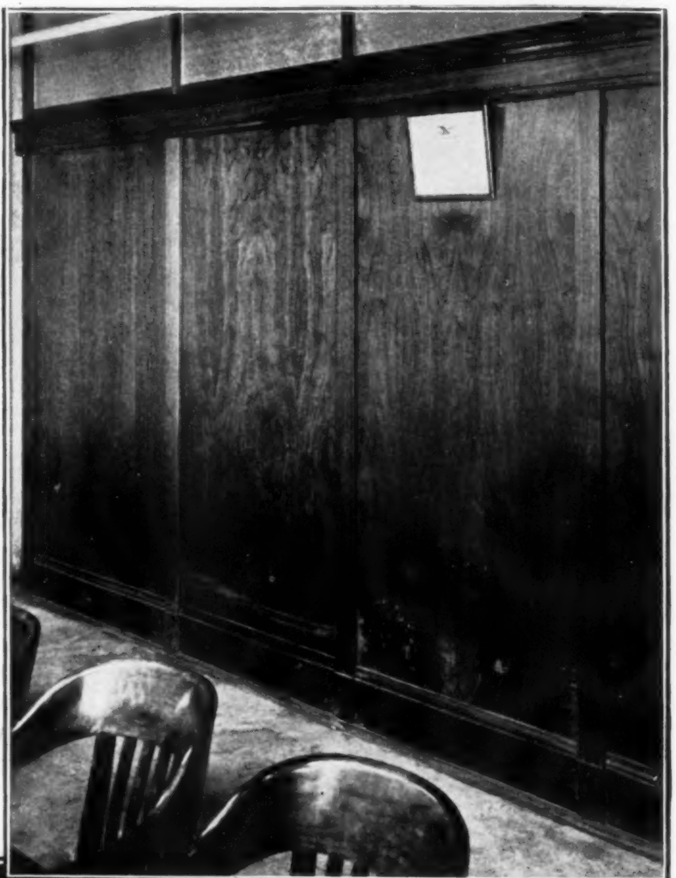
1. The linoleum had been ripped clear off the floor and had been floating in the room.

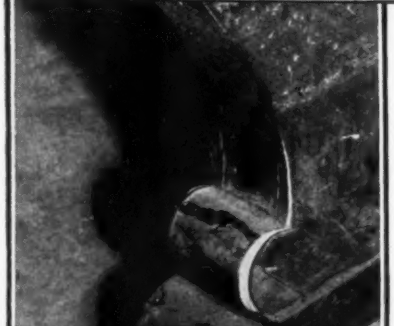
2. On the expensive Director's Table in the center of the room, the veneer had been torn away.

3. On a coupon booth just outside the room, the finish of the wood was utterly ruined.

With such havoc around it, you would expect the partition to be a total loss. You might expect it to collapse from the water pressure. Certainly its finish must be destroyed. But as a matter of fact the partition was practically unscathed. For it was Telesco Partition. Its beautiful walnut finish was unharmed, thanks to the exclusive lacquer used. The partition was as rigid as ever except at one point where shelves of stationery stored behind it came tumbling down against it! "We were amazed," writes Mr. J. O'Brien, vice-president of the bank, "at the remarkably fine appearance of the Telesco Partition in contrast to the other equipment in the room!"

Put Telesco under any test ... for durability of finish, for ease of erection, for movability, for *real* economy ... and its practicability will amaze you; just as its beauty, in luxurious American Walnut or African Mahogany, will impress the most exacting tenants.





AFTER THE FLOOD

(Photos shown were not retouched)

Above: Telesco Partition, unharmed.
At left: Leg of Director's Table, showing how veneer had been ripped away.

HENRY KLEIN & CO., INC.

with which are consolidated Improved Office Partition Co. and Driwood Corp. (Est. 1909)

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Telesco Partition
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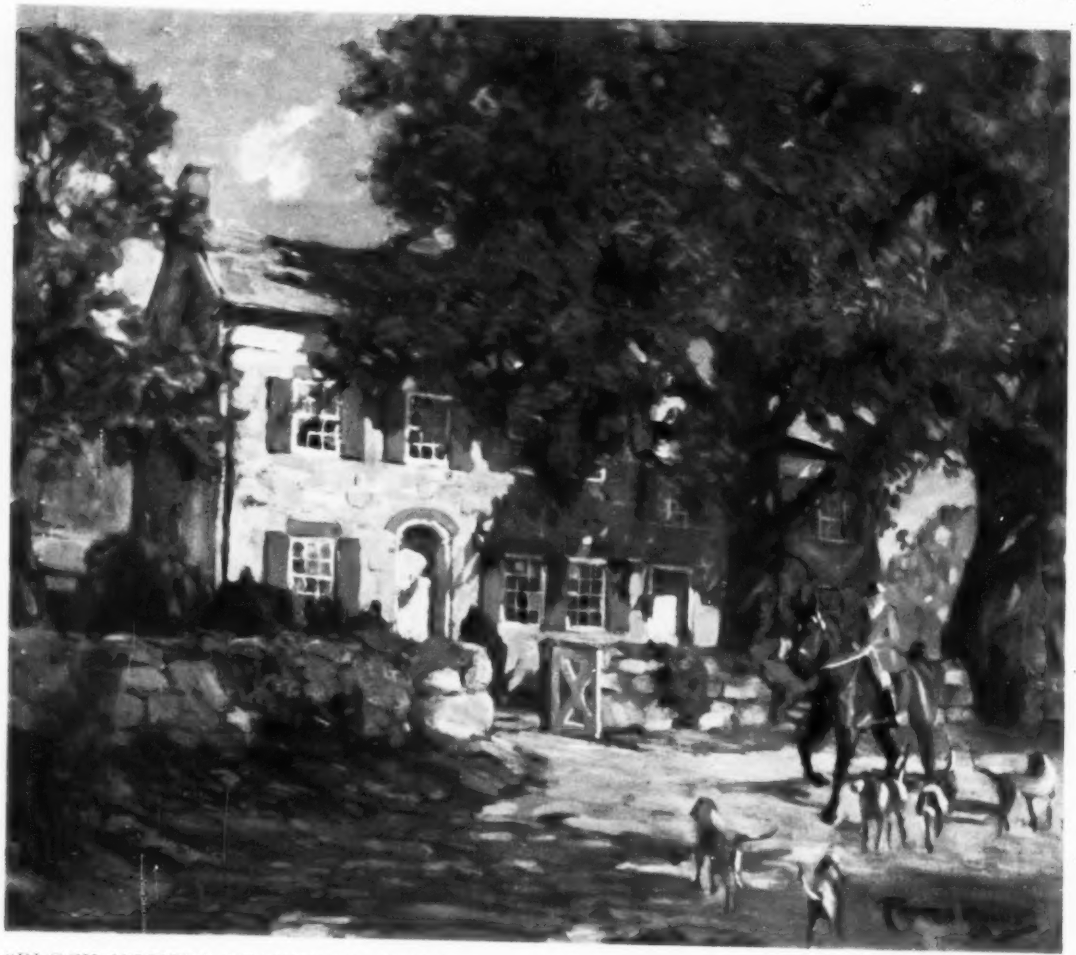
IT TELESCOPES

An Invitation

Just off Fifth Avenue, at 40-46 West 23rd St., Henry Klein & Co., Inc. has opened a huge store. Here you will find beautiful examples of paneled rooms for office and home ... as well as model offices displaying the use of various types of Telesco Partition. We invite you to come in ... for it is a veritable architectural exposition of craftsmanship in wood.



"BLOCK HOUSE," STANWICH, CONN.

From an Oil Sketch by Frank A. Wallis

UNIV OF MICH

THE
ARCHITECTURAL
FORUM
VOLUME LI NUMBER TWO
AUGUST 1929

THE "BLOCK HOUSE," STANWICH, CONN.

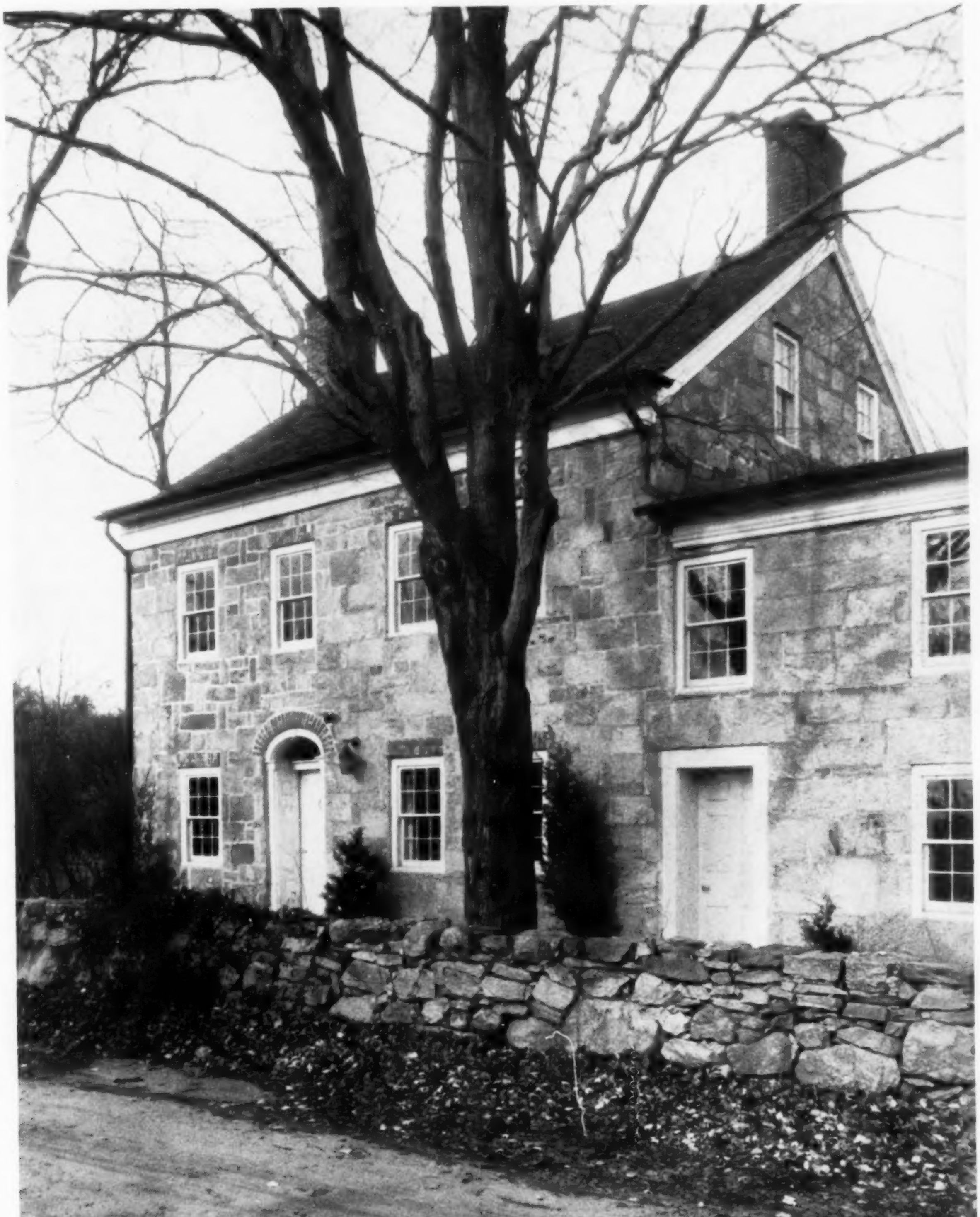
TEXT BY
STEPHEN HAWEIS
DRAWINGS BY
FRANK A. WALLIS

A CERTAIN woman was once talking to the Chinese ambassador at a distinguished gathering in Washington. "My passion," said she, "is American antiques. I collect them." And a slow, irrepressible smile overspread the face of the oriental diplomat. To one who habitually thinks of antiquity in terms of thousands of years, the very phrase, "American antiques" seems to be a contradiction in terms,—almost an "Irish bull." But we have a few things, already as obsolete as the astrolabe, which are both historic and antique. There are certain things and places which should never be forgotten and which should be most carefully preserved. Every memento of Washington and Lincoln is eagerly sought for. Tom Paine's house at New Rochelle, the old train in the Grand Central Station, and a host of other historical remains are already under watchful care. It is to he hoped that Robert Fulton's steamboat at Kingston will be rescued from decay before it falls to pieces. But if there is one thing of more interest than another to the millions who now find their chief joys in the possession of automobiles, it should be,—one would think,—the birthplace of the first American-made machine.

In 1858, one Simon Ingersoll, cousin of the great American freethinker, constructed a steam car at his home in the parish of Stanwich, near Greenwich, Conn., and drove it proudly into Stamford, a distance of about eight miles. The horrified sheriff of that day arrested his progress there and would, no doubt, have arrested Simon, too, if anybody else had known how to drive his infernal machine. As it was, there was nothing to do but order him to take it off the road as quickly as might be, on the score of its being a public menace,—probably a very just suspicion. Simon Ingersoll performed a right-about turn and drove the car home without accident. It did 16 miles over poor roads in safety,—that alone should not escape the recording stylus of Clio, the muse of history. The machine was then scrapped, and the inventor turned his hand to other things. Simon Ingersoll was not a man of one idea, nor were all his inventions interesting only because they were novel. He was a genius whose labors gave us the Ingersoll rock drill and the Ingersoll thrust bearing, both of which, with very little alteration if any, are in use today. Devices which make holes in rocks, and the details of the intricate machinery which carries us to Europe, are not very conspicuous in everyday life, but most of us are old enough to remember the days when "He had to get under, get out and get under, to fix up his automobile," had an intimate appeal which is almost dead today. Think what the emotions of a man must have been when he made, with his own hands, a car which necessitated no such thing, but was successful from the first.

The birth chamber of the first American motor car is situated about 50 yards behind the old "Block House" of Stanwich. It is a stone ruin now, but some day it will be restored, and it may even become a national monument. Odd that the "Block House" is of stone! It is not of Dutch origin, but a typical English west country house quite unlike the many stone houses of Ulster County, N. Y. New England was not healthy for the Dutch when the "Block House" was built, in 1721. Old country houses of that date are very rare indeed, if this be not the only one left. It was originally almost square in plan, to which a smaller wing was added in the same style about a hundred years later. Simon Ingersoll, who died poor, as is the traditional privilege of most of the world's benefactors, left the house to his widow, who was the last of the Ingersolls to own it. Here is a veritable American antique which should appeal to a variety of American interests,—a stone house in New England, long known and admired by architects, the birthplace of the American motor car, and the ancestral home of the Ingersolls. Both the father and grandfather of Robert G. Ingersoll lived here, so it is probable that Robert spent much of his time here, though he was not born in the house. Lovers of the past will be glad to know that the "Block House" is now the home of Huntington Adams, who has had it admirably

"BLOCK HOUSE," RESIDENCE OF HUNTINGTON ADAMS, ESQ., STANWICH, CONN.



Photos. George H. Van Anda

"BLOCK HOUSE," RESIDENCE OF HUNTINGTON ADAMS, ESQ., STANWICH, CONN.

MAIN FACADE

GARDEN FACADE

"BLOCK HOUSE," RESIDENCE OF HUNTINGTON ADAMS, ESQ., STANWICH, CONN.

MAIN DOORWAY
"BLOCK HOUSE," RESIDENCE OF HUNTINGTON ADAMS, ESQ., STANWICH, CONN.

MAIN DOORWAY
"BLOCK HOUSE," RESIDENCE OF HUNTINGTON ADAMS, ESQ., STANWICH, CONN.


LIVING ROOM

DINING ROOM

"BLOCK HOUSE," RESIDENCE OF HUNTINGTON ADAMS, ESQ., STANWICH, CONN.

Bedroom

Library

"Block House," Residence of Huntington Adams, Esq., Stanwich, Conn.

restored under the skillful supervision of Parker Morse Hooper, the architect. Shaded by huge trees, of which at least one must be fully as old as the house, it stands close beside the road. Its walls are 20 inches thick, and the plaster, on the inside, where it has not been removed to show the beauty of the hand-faced stone, is applied directly to them. Another curious feature in the building is the brickwork over the windows, curious since there were practically no brick made in this country at that date. The Fraunces Tavern in Broad Street, New York, has similar brick arches, and it may be that the few used in the "Block House" were part of the consignment imported from Swansea for the other building. Brick were made in a factory in the Delaware valley at a very early date, but they must have been rare in Connecticut.

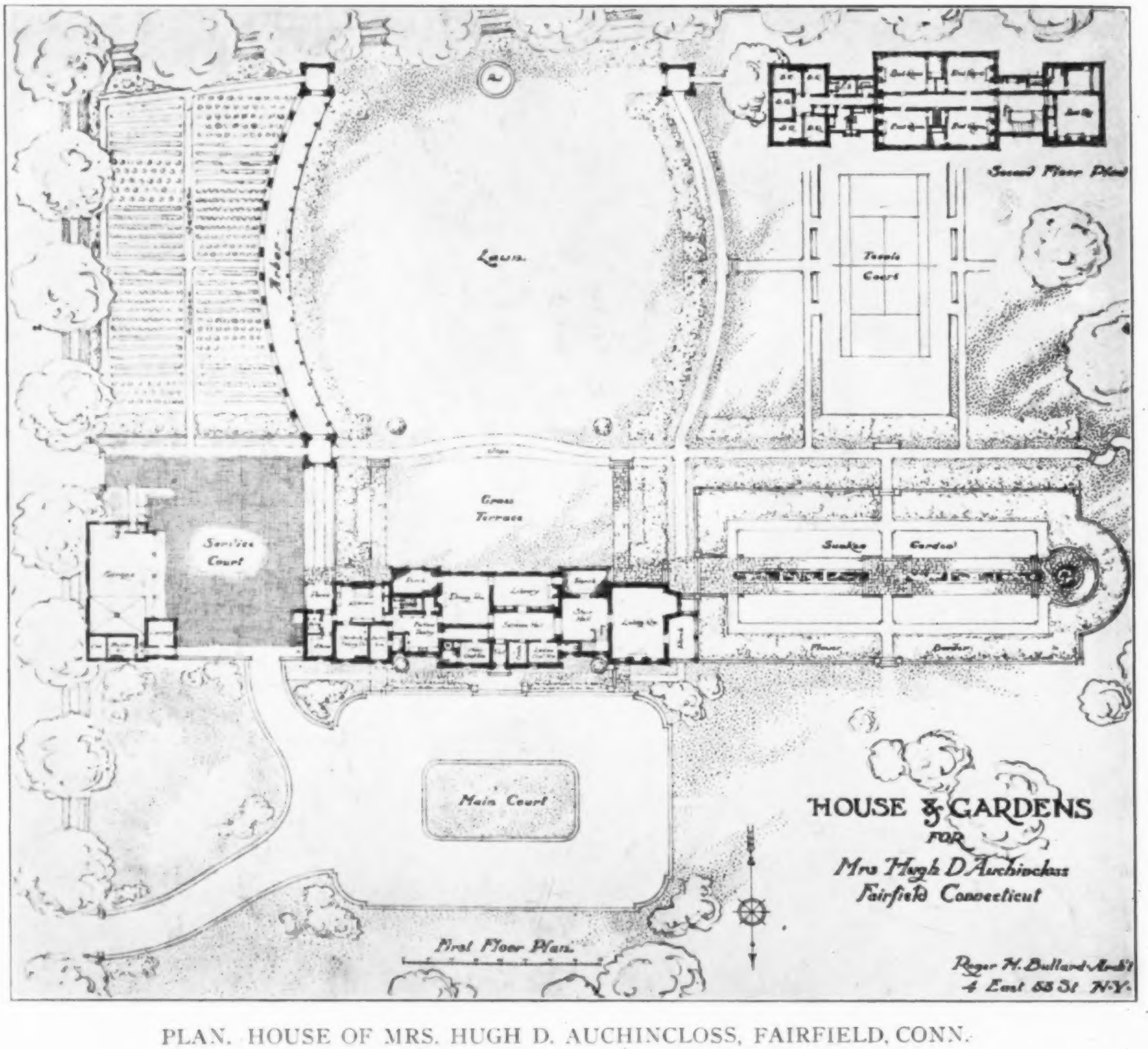
Perhaps these details are of less interest to the average citizen than they are to specialists. More poignant historical associations are not wanting, though particulars may never be found and proved. It is certain that this house was built so strongly to repel the attacks of the Myano Indians who had their forts throughout the wooded hills behind the house. The valley of the Mianus River is still the wildest and least visited section of the country within 50 miles of New York. Women who were our great great grandmothers were hurried to safety within these walls, while great great grandfathers, armed with flintlocks and blunderbusses, stepped warily from the shelter of a rock to that of a covering tree, hoping for a shot at the Indians. There is romance a plenty in American annals which was not recorded by our forefathers because the tragic events of daily life were so common as to cease to be remarkable. If Uncle were late for supper, it was not his club which was the cause of his default, but someone else's club! It was more than likely that the body would be found with a neat circle of skin skillfully removed from the scalp!

Coming down to Revolutionary times,—the days of yesterday by comparison,—the old "Block House" played its part nobly. Half a dozen or more of the defeated soldiery made their way to it after the Battle of White Plains. They could not hide in a conspicuous house by a public road but the old stone house concealed behind it in the woods, which long afterwards became Simon Ingersoll's workshop, was an ideal retreat. The Ingersoll family kept them hidden and fed them for weeks until it was possible for them to escape.

In imagination I can see an endless procession of cars and trucks, cultivators and business wagons, reverently visiting the first factory and garage, the place from which the great great grandfather of millions of Fords and Packards, Buicks and Cadillacs ran his first Marathon of 16 miles, —a building deserted and broken up in the prime of life, to be utterly forgotten until the year 1924.

Photos. George H. Van Anda *Plan on Back*

HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

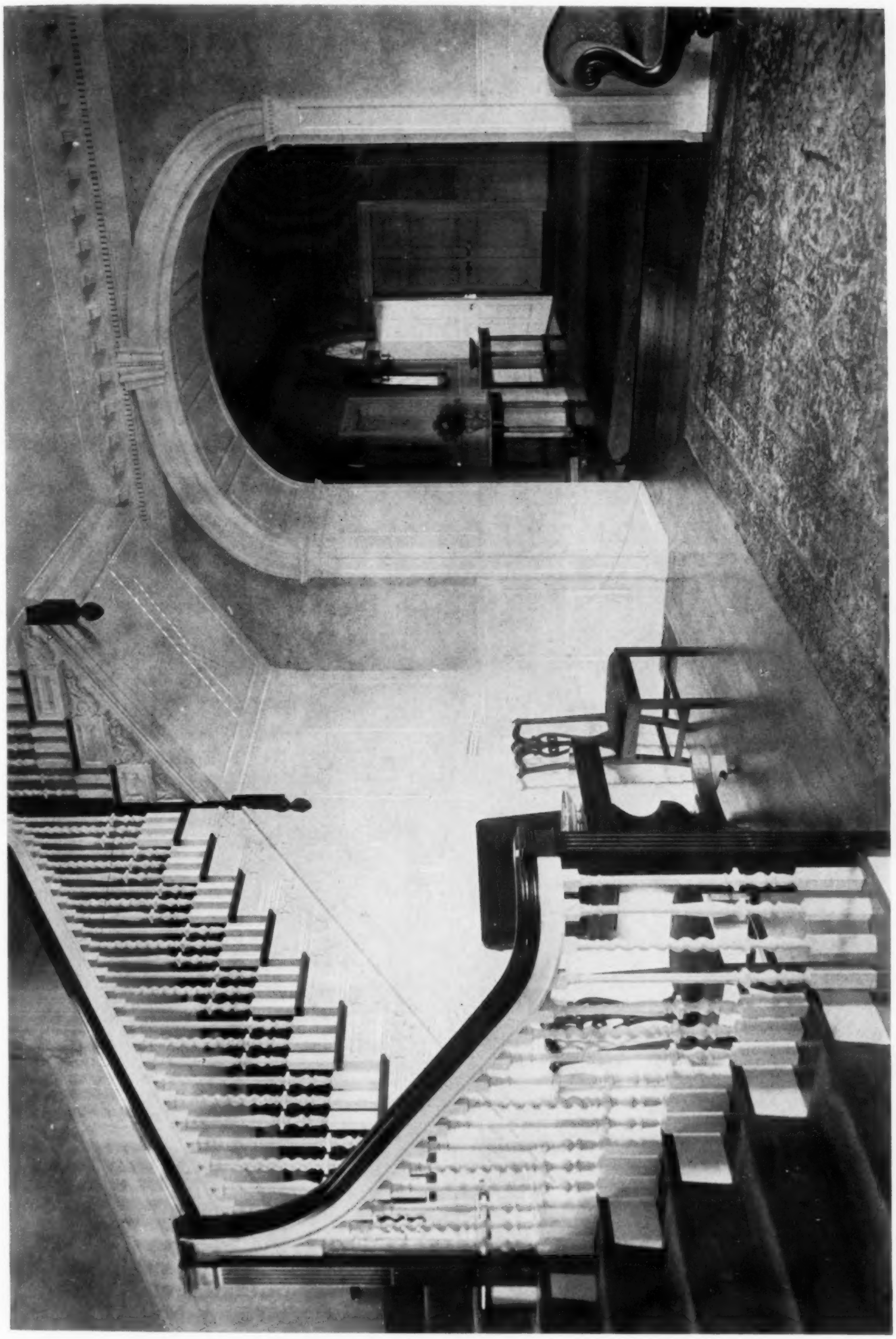


PLAN. HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

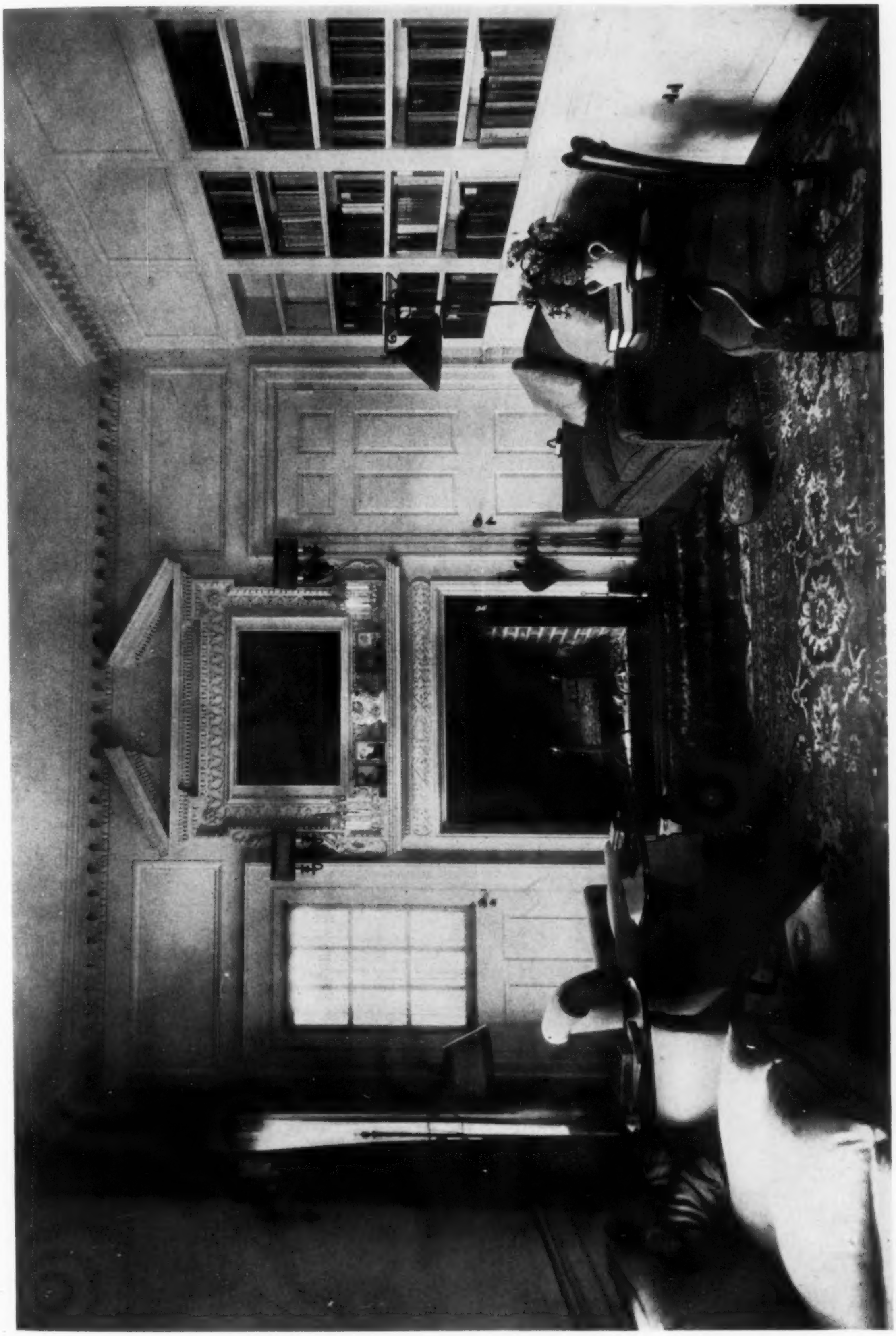
A GENERAL VIEW
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

ENTRANCE FACADE
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

LIVING ROOM FIREPLACE
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT



ENTRANCE HALL
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT



LIBRARY
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

DINING ROOM
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

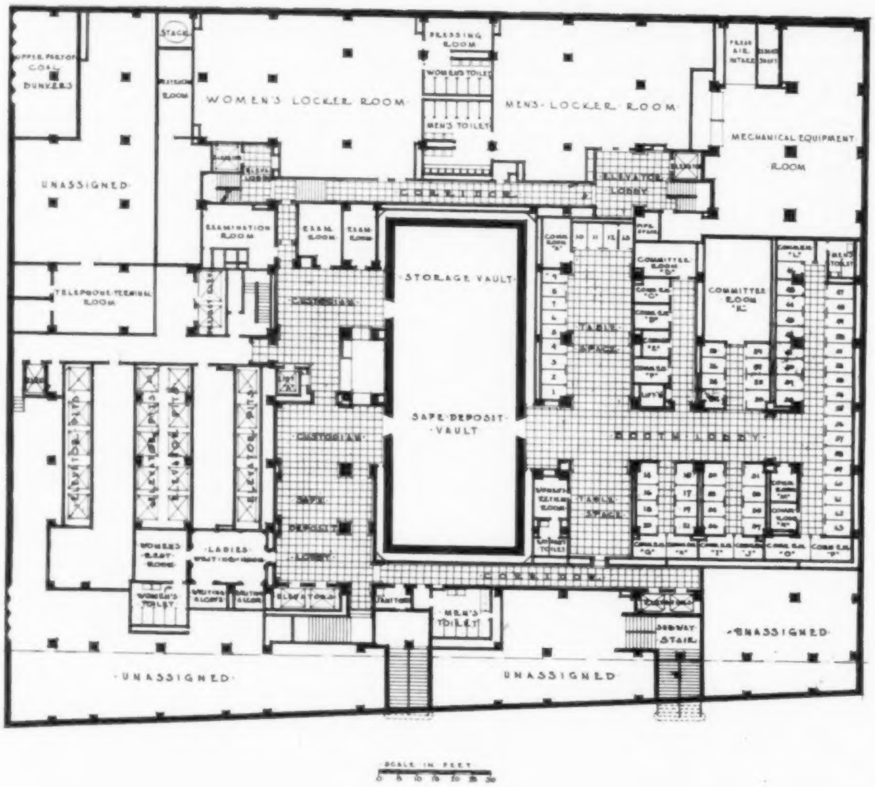
TWO BEDROOMS
HOUSE OF MRS. HUGH D. AUCHINCLOSS, FAIRFIELD, CONN.
ROGER H. BULLARD, ARCHITECT

Photos, Richard T. Dooner

Plan on Back

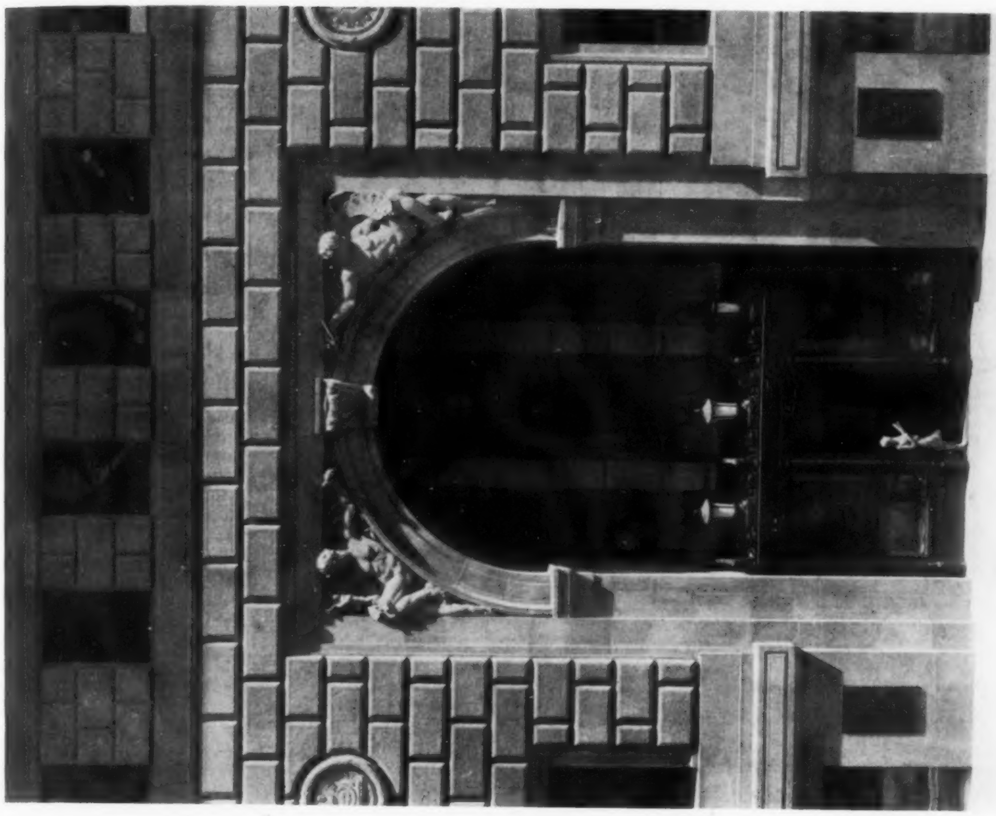
FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA

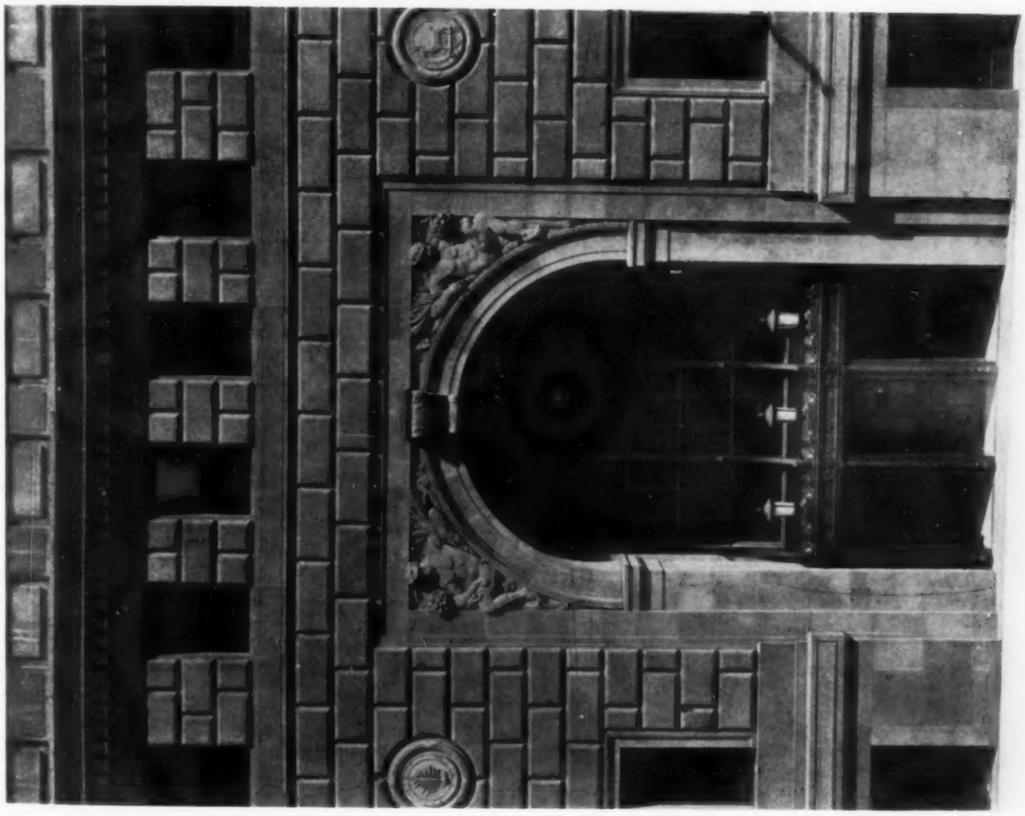
SIMON & SIMON, ARCHITECTS



BASEMENT FLOOR

PLAN. FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA
SIMON & SIMON, ARCHITECTS





OFFICE BUILDING ENTRANCE

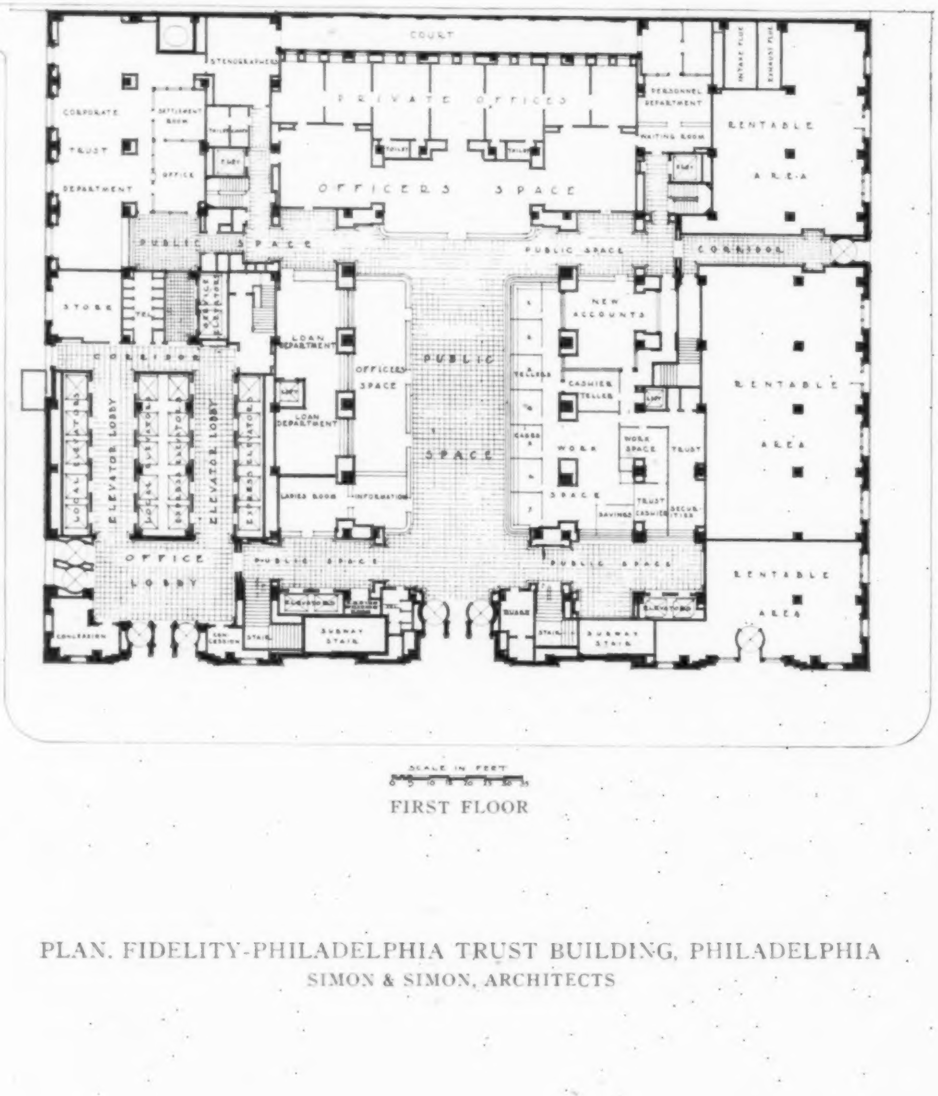
B. & O. TICKET OFFICE ENTRANCE

FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA

SIMON & SIMON, ARCHITECTS

Plan on Back

UNIV OF MICH



FIRST FLOOR

PLAN. FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA

SIMON & SIMON, ARCHITECTS

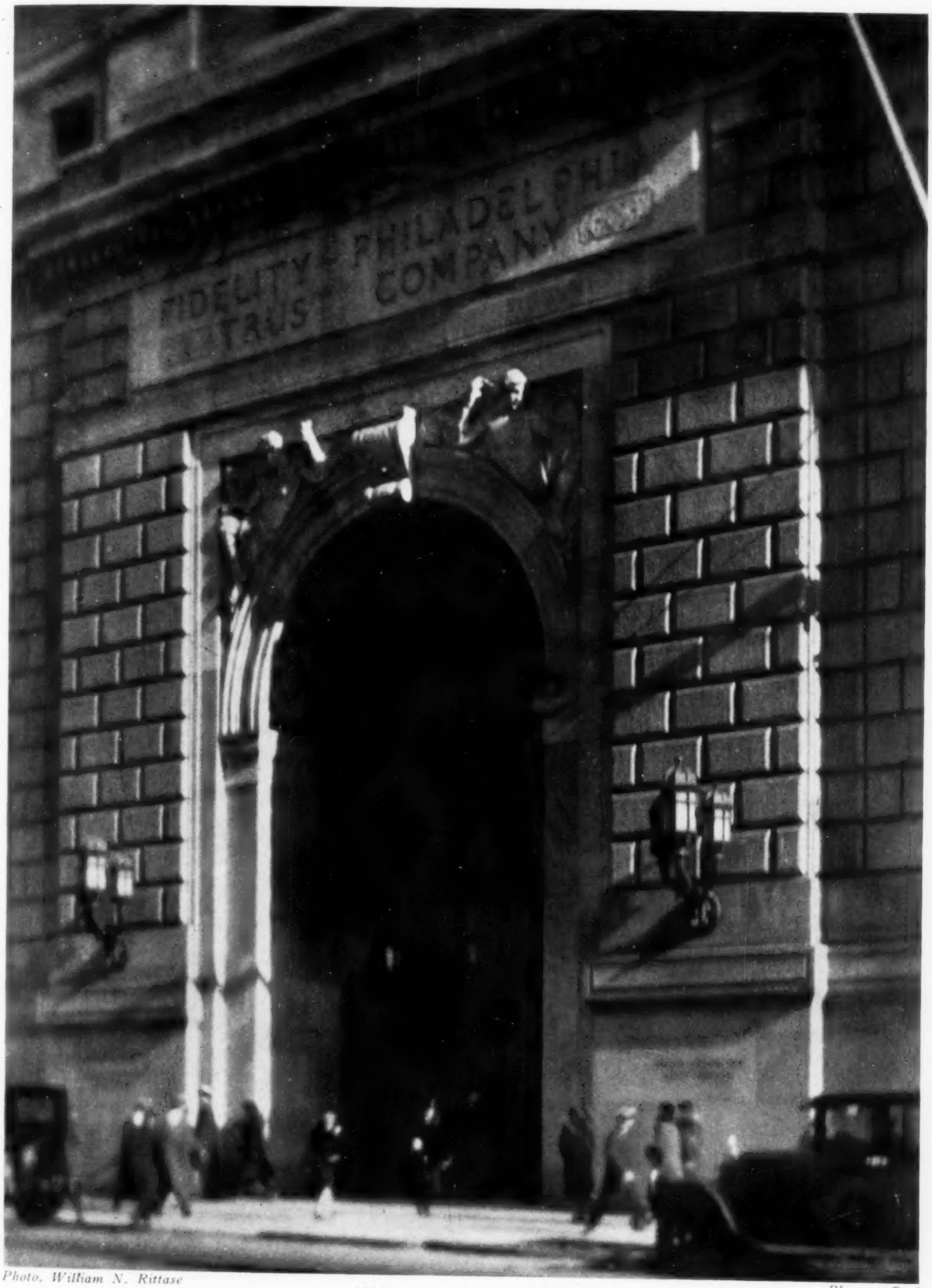
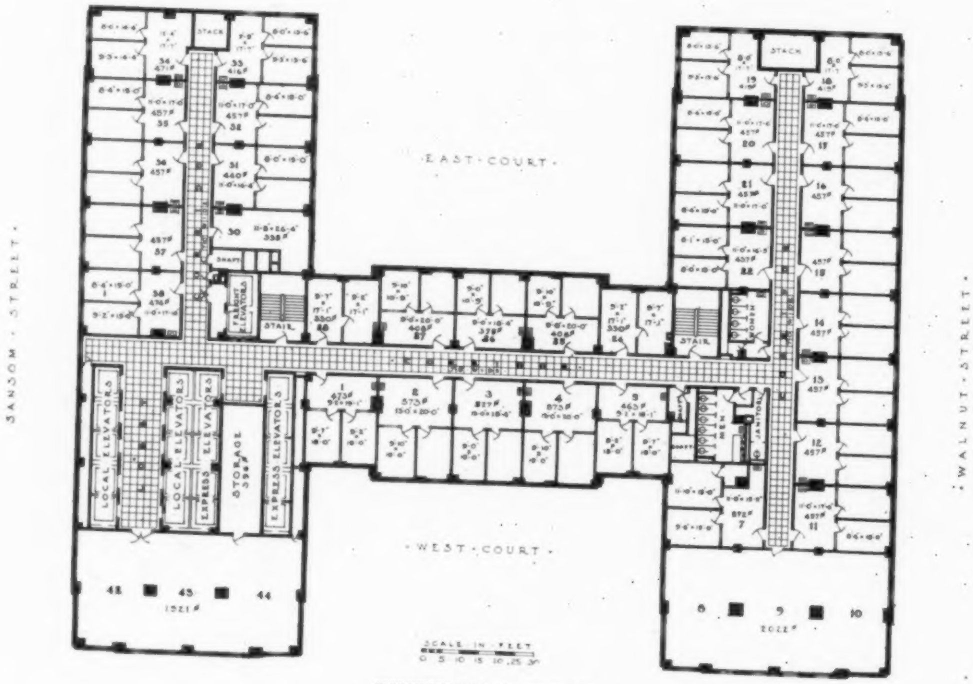


Photo. William N. Rittase

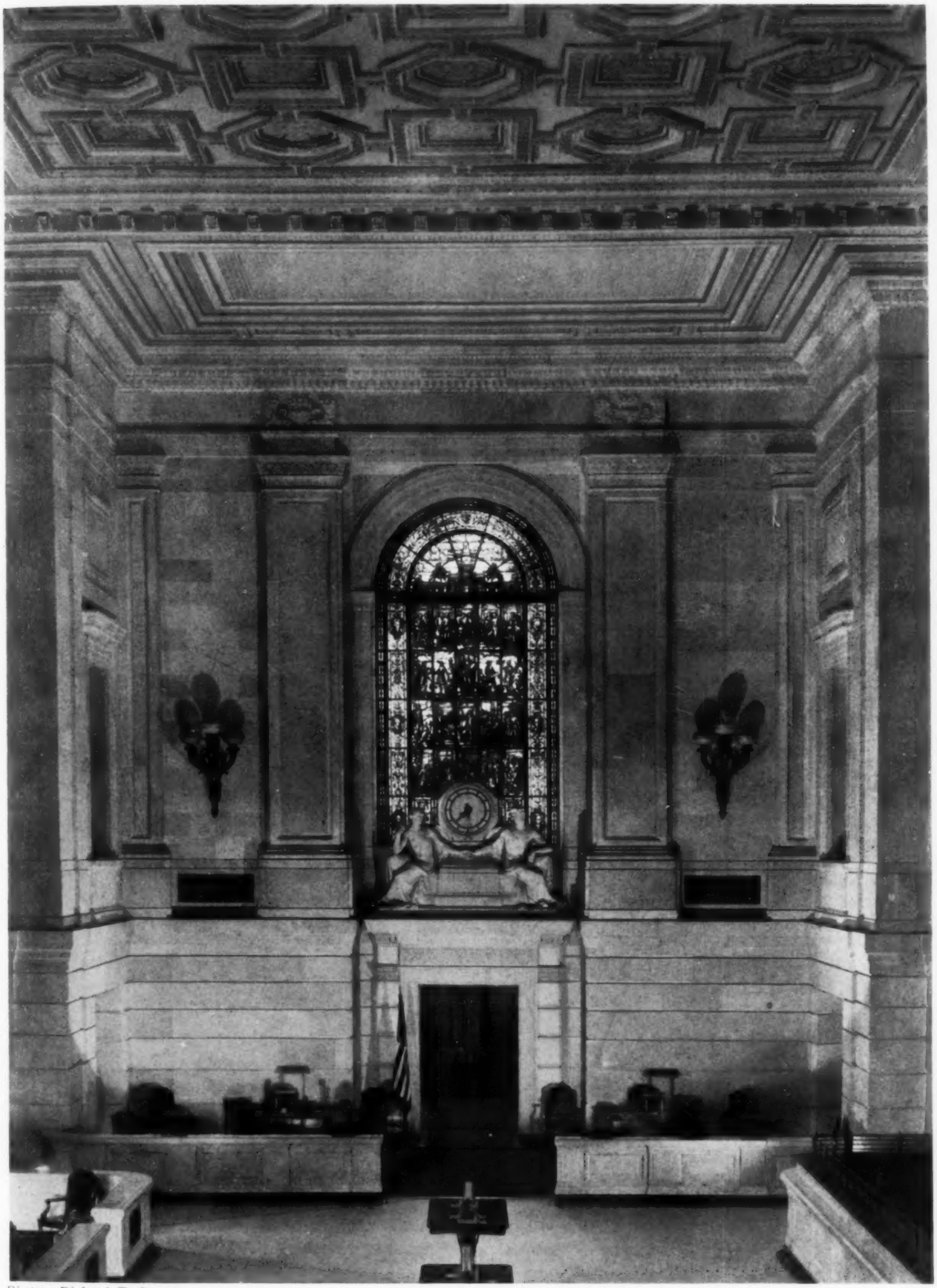
Plan on Back

MAIN ENTRANCE TO BANK
FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA
SIMON & SIMON, ARCHITECTS



THIRTEENTH FLOOR

PLAN. FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA
SIMON & SIMON, ARCHITECTS



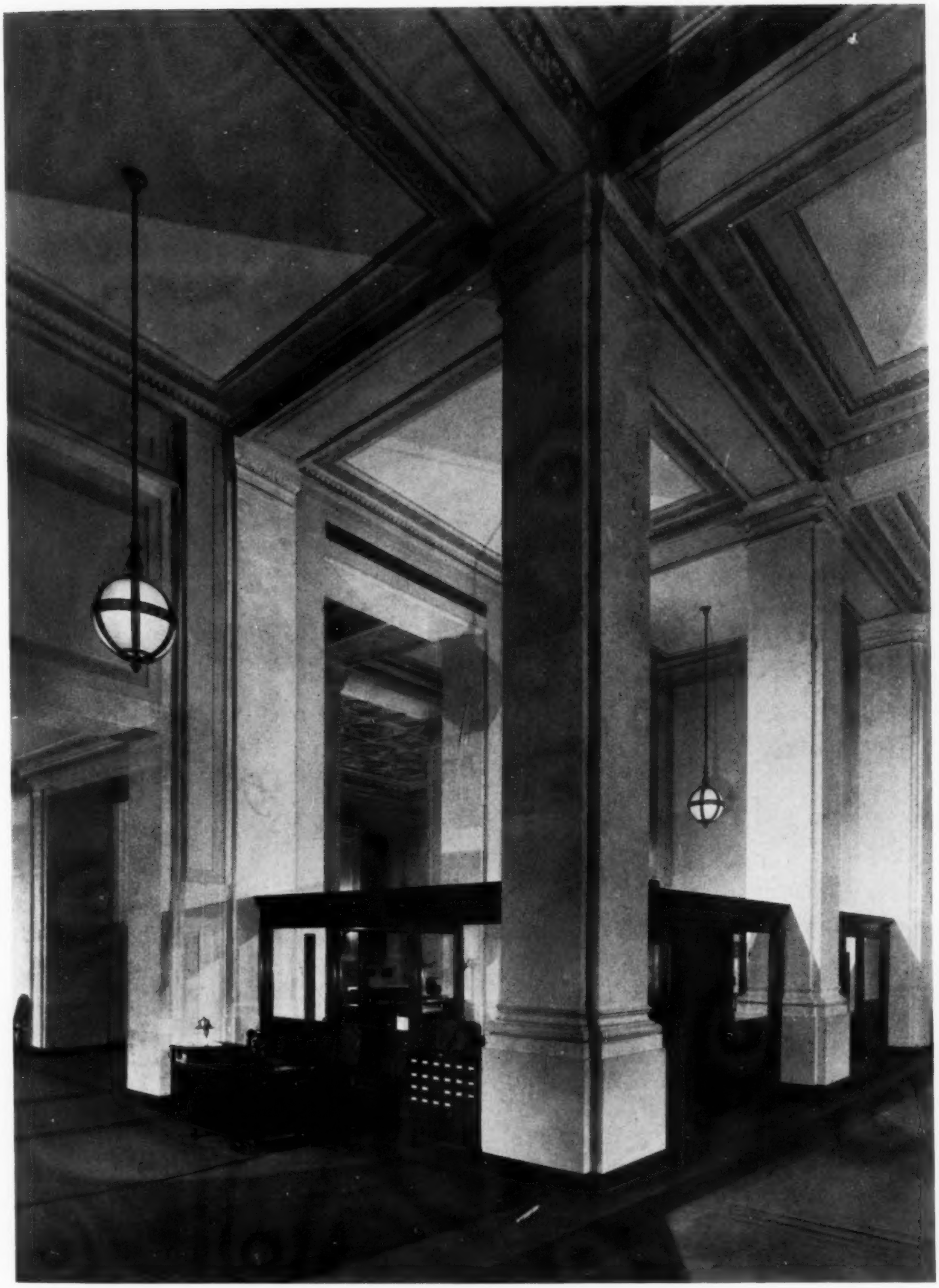
Photos. Richard T. Dooner

END OF MAIN BANKING ROOM

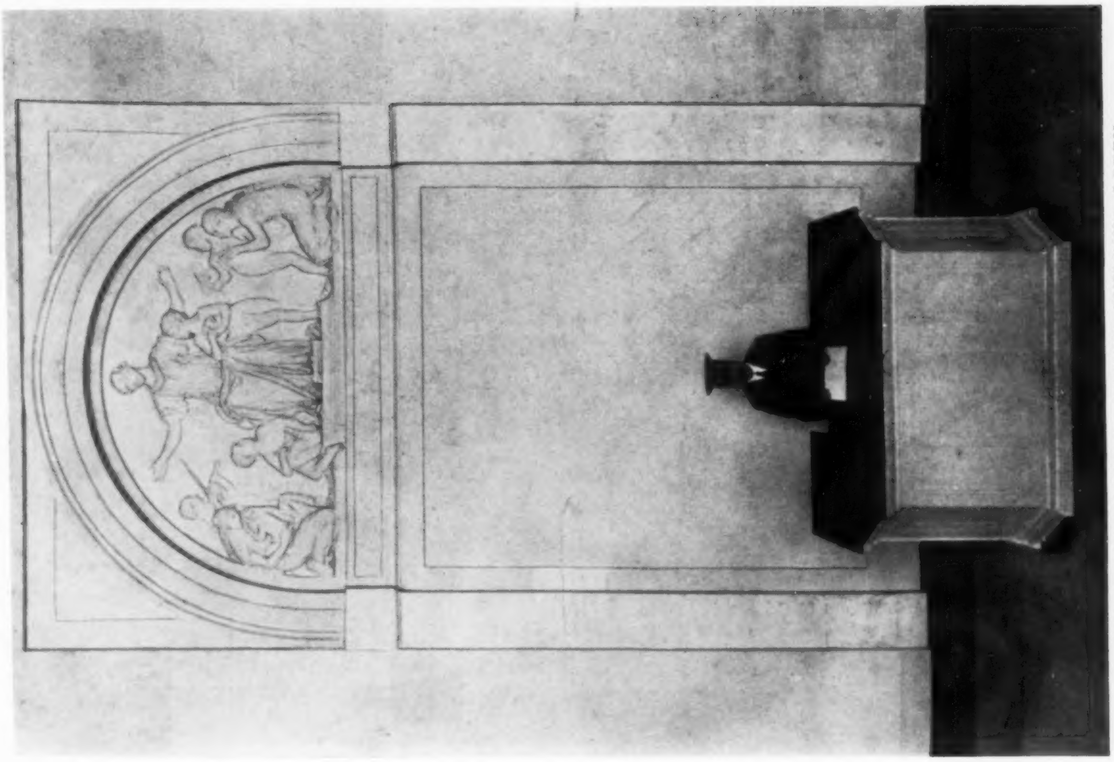
FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA

SIMON & SIMON, ARCHITECTS

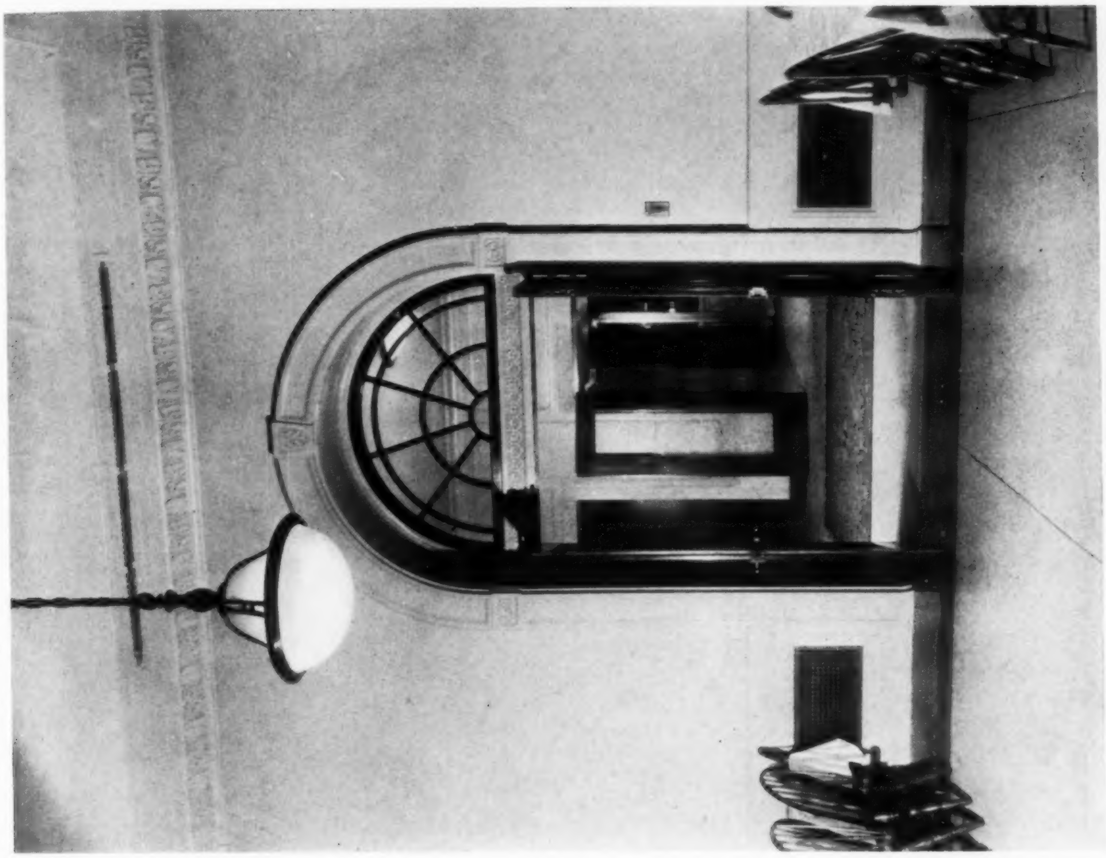
TRUST DEPARTMENT
FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA
SIMON & SIMON, ARCHITECTS



TRUST DEPARTMENT
FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA
SIMON & SIMON, ARCHITECTS



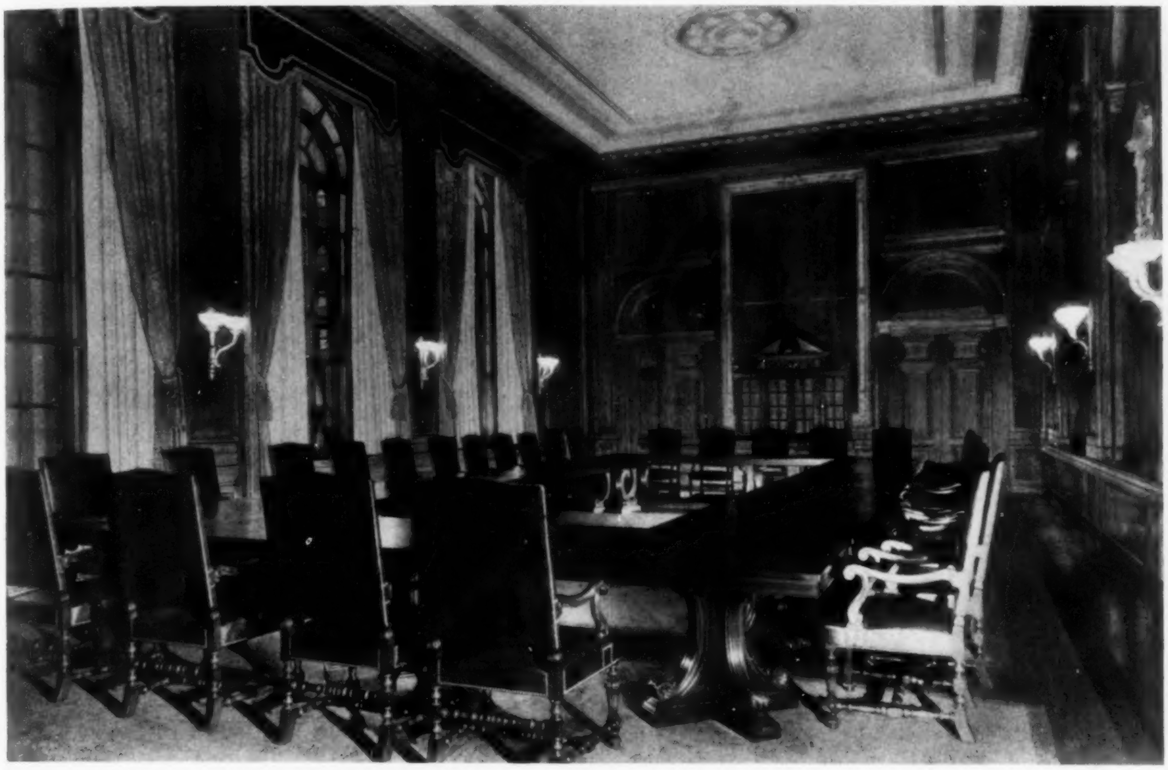
INFORMATION DESK, OFFICE BUILDING LOBBY



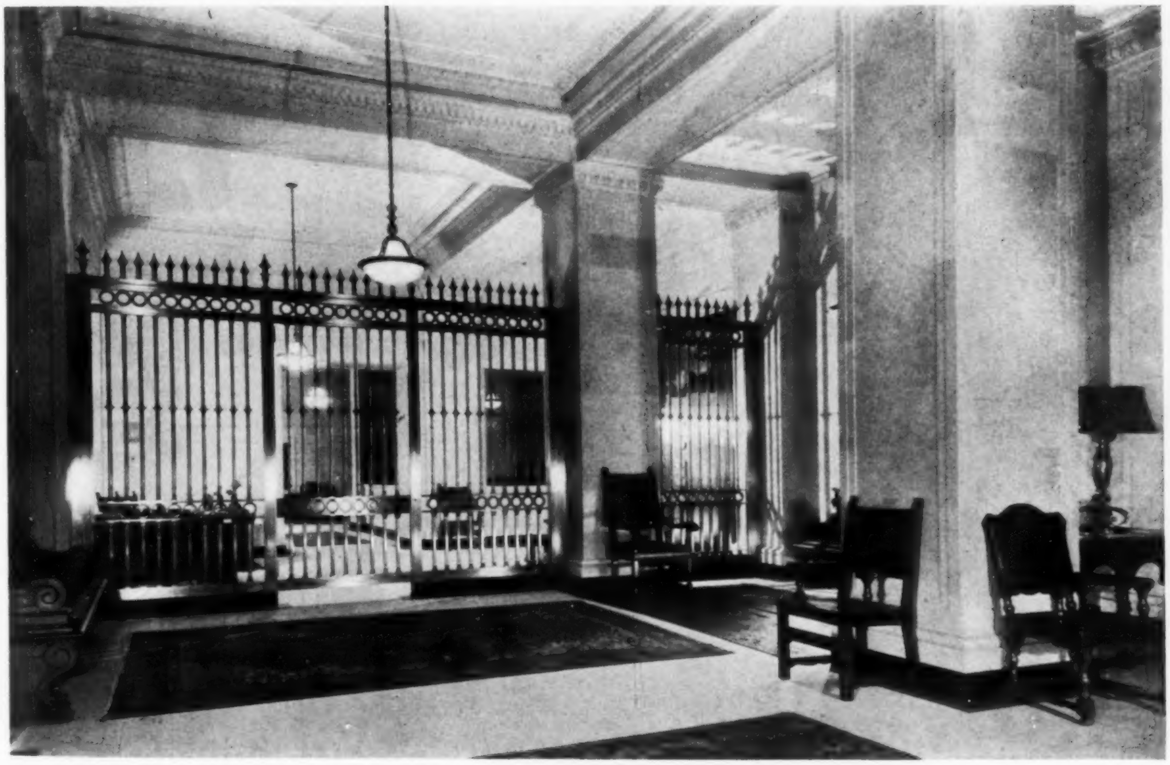
DOORWAY, BANK EMPLOYES' DINING ROOM

FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA

SIMON & SIMON, ARCHITECTS



BOARD ROOM



LOBBY, SAFE DEPOSIT DEPARTMENT

FIDELITY-PHILADELPHIA TRUST BUILDING, PHILADELPHIA

SIMON & SIMON, ARCHITECTS

THE FIDELITY-PHILADELPHIA TRUST BUILDING

SIMON & SIMON, ARCHITECTS AND ENGINEERS

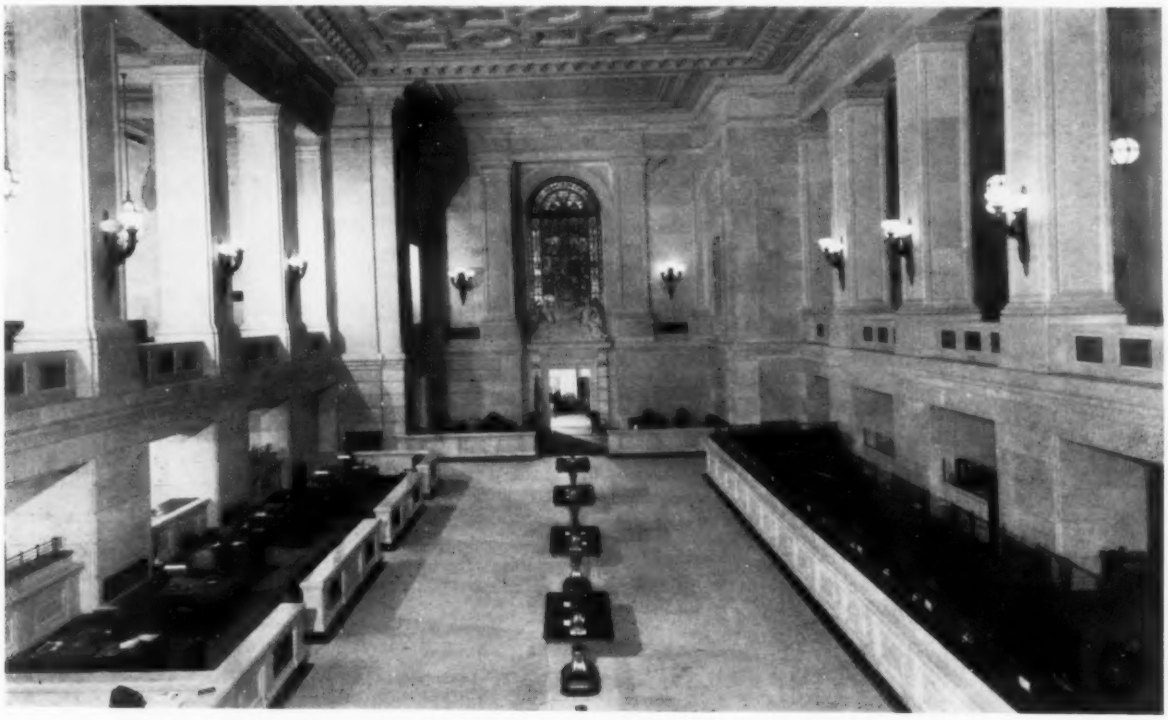
BY

EDWARD P. SIMON

THE recently completed 32-story Fidelity-Philadelphia Trust Building, Philadelphia's largest office structure, stands in South Broad Street, occupying a block frontage of 221 feet, 6½ inches on that street and extending along Walnut and Sansom Streets to a depth of 175 feet, 11 inches. The major portions of the ground and basement floors and all of the first five office floors are used as a banking house for the Fidelity-Philadelphia Trust Company, which institution, through a subsidiary real estate company, financed and owns the building. Twenty-four floors are given over to leased office space, while the top floors are occupied by a luncheon club.

Access to the office building lobby and the elevators is through the entrances at the corner of Broad and Sansom Streets, since this corner of the building lies nearest to the avenues of approach from the most populous parts of the city. The 24 floors of rented offices have a usable floor area of 402,507 square feet or about nine acres. The building has a total usable floor area of 618,249 square feet or more than 14 acres. Considerable study was given to the provision for such expansion of the banking house as might come through future mergers or from the natural growth of business. It is interesting to note that such a merger actually occurred and at a time when the architects' drawings were still in process and might easily have been altered, but due to the provision which had already been made, it was found necessary to only slightly change the design. Another problem considered by the architects was that of securing the ideal dimensions for office bays and depths. In an endeavor to get expert opinion on this question, the owners and the architects invited a conference of the Building Planning Service of the National Association of Building Owners and Managers. This meeting took place in Philadelphia with delegates arriving from points as far distant as the Pacific coast. After several days of open discussion, a ballot was taken which resulted in the establishment of these proportions as the ideal for an office building of this size: The width of the units to be nearly constant at from 17 feet to 17 feet, 6 inches. The depths, measured on a line parallel to the direction of the light, to be allotted in this way: 45 per cent of the units to be 20 feet deep, 45 per cent of the units to be 25 feet deep, and 10 per cent of all the units to be 28 feet deep.

Two factors determined the choice of the architectural treatment. The problem was to design a building in keeping with neighboring structures and in accord with Philadelphia's conservative traditions and at the same time afford a dignified



Main Banking Room

style of decoration suited to the character of the banking institution which occupies the dominant position in the structure. Classic design was clearly indicated. As the study in this style of decoration progressed, opportunities were presented for the introduction of a number of sculptural features, notably the spandrel reliefs over the entrance arches, the cornice and spandrels over the board room windows, the coins in relief along the lower facades, the lunette in the office building lobby, and the two figures in the round which support the clock at the end of the banking room's interior. These sculptural contributions as well as the ornamental bronze entrance doors and their frames are the work of Piccirilli Brothers, sculptors, of New York.

The early American coins and medals, represented in a series of medallions above the second floor level on the three facades, seem worthy of a detailed description. Beginning at the west end of the Sansom Street facade, there is a representation of the obverse side of a coin authorized by the legislature of Vermont and minted at Rupert, Vt., by Reuben Harmon, Jr., showing the inscription "*Vermontis Res Publica,* 1785," with a plough in the foreground and the sun rising from behind mountains. At the north end of the Broad Street facade is a representation of an American pine tree three-pence piece with a pine tree in a field under the inscription "Masathusets" and the date, 1653. The next medallion, proceeding south along the Broad Street facade, is a reproduction of the Granby copper with a standing deer and the inscription "Value Me as You Please," dated 1737. These coppers and other coins were struck off by one Highley, a blacksmith, at Granby, Conn. The next coin is the first authorized United States cent. It shows a dial with three hours and the word "*Fugio*" as well as the inscription, "Mind Your Business." On the face of the coin are 13 circles linked to form a large circle. The minting of this coin was ordered by Congress, July 6, 1787. Another Vermont coin is carved at the south end of the Broad Street facade. It shows the "All-seeing Eye" directing its rays upon 13 six-pointed stars and bearing the inscription, "*Nova Constellatio,*" 1783. Two of these coins in silver were found near Newark, Del., in a secret drawer of an old desk that had belonged to Charles Thomson, a close friend of Benjamin Franklin. Turning the corner and at the west end of the Walnut Street facade is the face of the Lafayette medal, commemorating the triumph of the American forces over Burgoyne in the Revolutionary battles at Saratoga, October 17, 1777, and over Cornwallis,

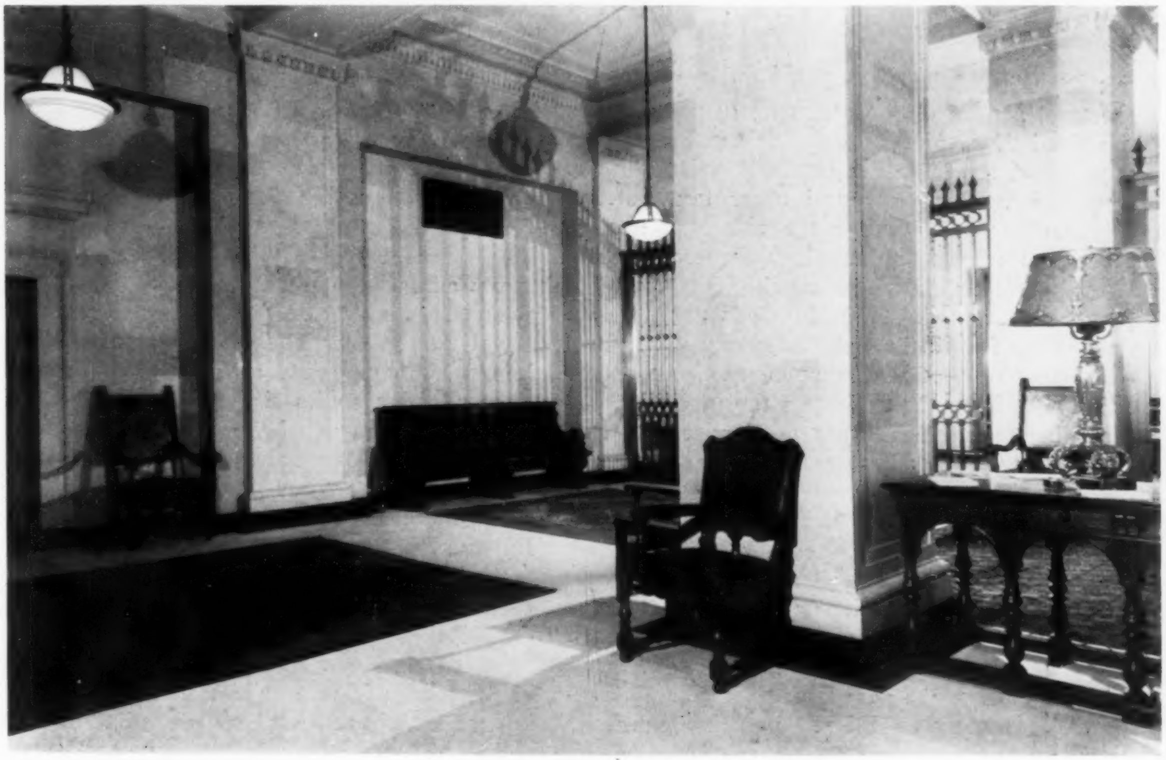
Trust Department
Fidelity-Philadelphia Trust Building, Philadelphia
Simon & Simon, Architects

at Yorktown, October 18, 1781. The reverse of this medal is at the east end of the Walnut Street facade. All these medallions are highly decorative.

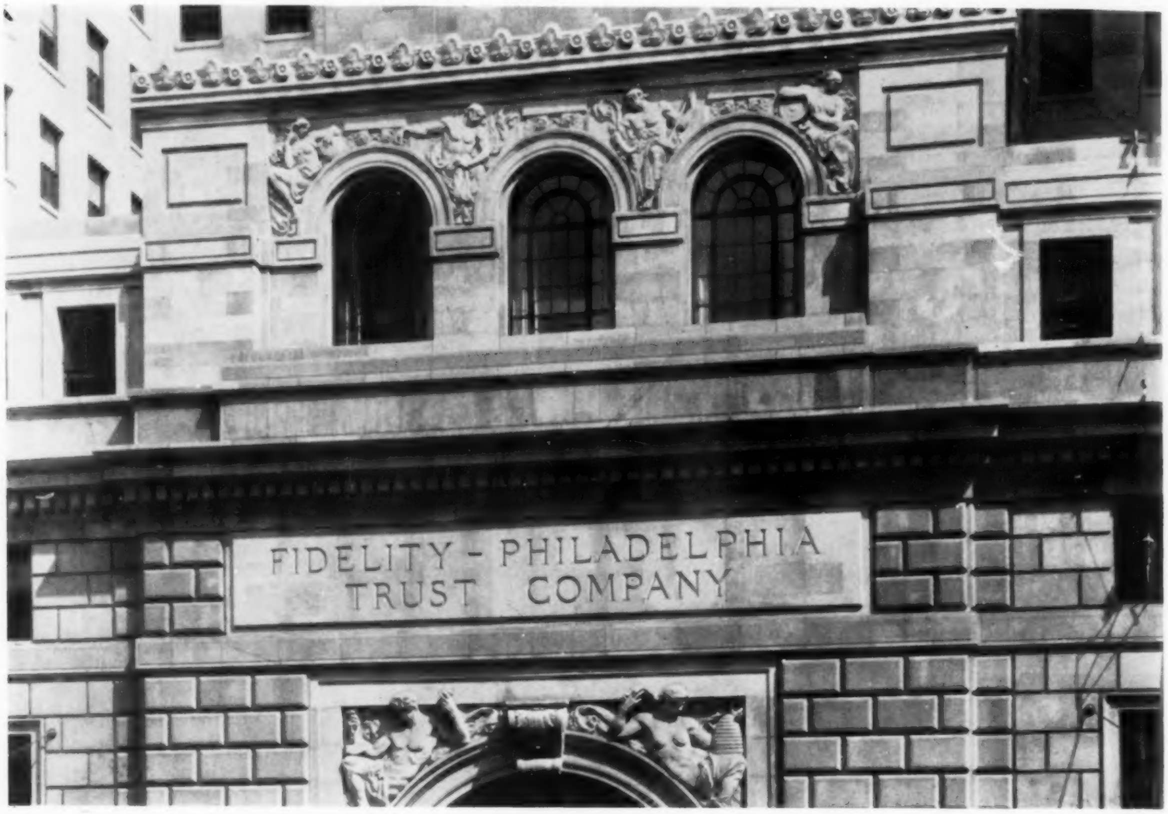
Approach to the banking room, through the main entrance from Broad Street, is on the street level. This room is 119 feet long, 54 feet, 11¾ inches wide, and 46 feet, 9½ inches high. The illumination of the room is carried out with the view to giving an even radiation of light to all parts of the working area and customers' spaces and with the further stipulation that the light originate from sources which will be instinctively sensed as natural. To prevent on the east wall the glare that must have resulted from the dependence on or accentuating of the daylight coming from the Broad Street windows, it was thought advisable to include an apparent source of light in this wall, which was accomplished by use of a stained glass window. This records historic incidents of Philadelphia and contains as well medallion portraits of famous Philadelphians. It is one of the best in the city and one of the few in the country devoted exclusively to the portrayal of secular history. This window and the leaded window over the main entrances were created by the D'Ascenzo Studios, Philadelphia.

Direct illumination, falling at a natural angle from side brackets, fills the banking room with a soft, even glow of light. Incidentally, it may be interesting to note that this is believed to be the largest banking room in America to be lighted solely by side brackets. Honed Tavernelle Claire marble forms the walls and wainscoting of the room. There were imported from the Chiampo quarries, near Verona, for the interior facings of the building, 20,000 cubic feet of this marble. The coffered ceiling of the room is modeled in plaster and decorated in soft coloring in key with the marble walls. An ingenious system allows the ceiling to receive its occasional cleaning from scaffolds to be suspended from invisible attachments in the ceiling itself. Along the south side of the banking room is the tellers' space. Polished marble counters surmounted with screens of bronze and glass of the low type eliminate the familiar tellers' cages. Along the north side and at the east end of the public space are marble railed divisions for officers.

Six private bank elevators, four for customers and two for employes, as well as stairs, give access to the trust department on the second floor. Here, as on the first floor, the public area is in the center with rooms for officers along each side, and as elsewhere in the bank's quarters, the wood used in the trim is prima vera (white mahogany). From this second floor, balconies overlook the main banking space. The north and east portions of this floor are occupied by the



Lobby, Safe Deposit Department
Fidelity-Philadelphia Trust Building, Philadelphia
Simon & Simon, Architects



Detail, Main Entrance to Bank
Fidelity-Philadelphia Trust Building, Philadelphia
Simon & Simon, Architects

tax departments and the library. Facilities for the trust accounting department are provided on the third floor, and here also is the income tax department available for service to clients in the preparation of returns and other tax matters. On the fourth floor are the photostat department, the mimeograph and duplicator, general ledger, bank bookkeeping, transit, mail, addressograph, general index and files departments. Girders at the fourth floor level spanning a distance of 60 feet support the entire central part of the 27 stories, form the ceiling of the main banking room below, and eliminate all vertical obstructions from the most important space in the building. As the girders are nearly 10 feet in depth, the space between them is utilized for the general files. A first aid dispensary and infirmary are on this floor, intended for the service not only of the bank and its patrons, but also for building tenants, their employes and visitors. The board room, which forms a dominant feature of the main facade, is reached by private elevators. This room is finished in prima vera, its deep texture and warm color accentuated by touches of dull gilding and a gold clock on the wall. The board room has as dependencies an ante room and a small committee room, with interiors to harmonize. On this same floor, the fifth, are the officers' dining rooms and the dining room for employes where three hundred persons can be served at one sitting. A kitchen with ample equipment provides for the preparation of meals. The real estate department, with its many activities and sub-divisions, is located on the sixth floor. For the safeguarding of thousands of important documents, a large vault is provided immediately adjacent.

In addition to its size, this building is noteworthy on account of the exceptional quality of materials employed and the remarkable speed with which it was erected. The outer veneer above the base of pink granite is of selected buff Indiana limestone, while all the door and window frames are of bronze. From the time wreckers began clearing the site until the Baltimore & Ohio Railroad ticket office was open for business on the ground floor of the new building, there had elapsed a few hours less than one year. Within four months more the structure had been completed and turned over to its owners and their tenants. To a time-sensitive people this achievement is not lacking in a certain dramatic quality.

THE CHURCH OF INFINITY

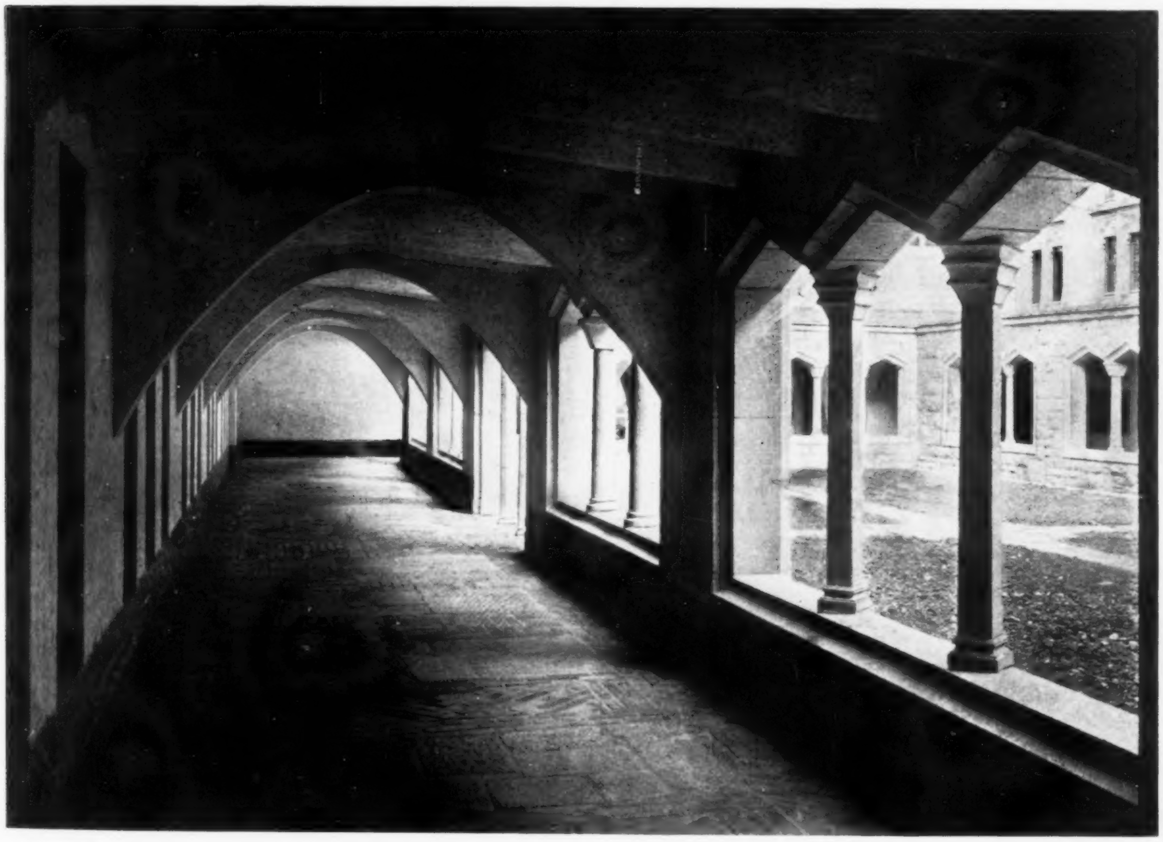
BY

FRANCIS S. ONDERDONK

INSTRUCTOR IN THE COLLEGE OF ARCHITECTURE, UNIVERSITY OF MICHIGAN

PROFESSOR H. E. BARNES called man a "temporary chemical episode on a celestial juvenile and cosmic dwarf." Orthodox priests who had ignored astronomical discoveries were shocked, and freethinkers rejoiced. But progressive friends of religion who derive no income by propagating an ancient creed will say in accord with H. G. Wells, Sir Oliver Lodge and L. N. Tolstoy: "Yes, we are weak primates on a cosmic dwarf, but yet part of an infinite universe, at least one so vast that the term infinite best describes it; we are transitory and stand with one foot in our graves; but with our arms we touch infinity, and eternity is our background. This is our tragedy but likewise our opportunity. We cannot rest content at the fireplace but must seek to explore the Antarctic or try to fly across the Atlantic; a slow train makes us feverish, and races thrill us into a higher state of being. Yet these are substitutes used by moderns who do not know how to scale infinity by the aëroplane of the soul,—faith; who have lost the knowledge of quenching their thirst for the eternal by developing an inner fountain."

Architecture symbolizes the thoughts and longings of an age unless it hypocritically masquerades in the symbols of a past generation. That the parabola is the geometrical expression of the "half finite, half infinite" consciousness of our age was discussed in an article in Part II of THE ARCHITECTURAL FORUM for November; that its structural virtues were discovered by the engineers and that the liquid quality of concrete makes possible the introduction of such a subtle arch with ever-changing curvature were likewise pointed out. New examples of the application of parabolic or elliptical arches are to be seen in the gymnasium of the school in Suresnes, France, in the hall of the Royal Horticultural Society in London, and in the main halls of the Czechoslovak Exposition at Brunn, Moravia. In the latter instance the upper part of the vault consists of a network of concrete ribs framing glass panels; it proves that the para-



Pallotiner Church, Limburg

J. H. Pinand, Architect

PULPIT AND APSE

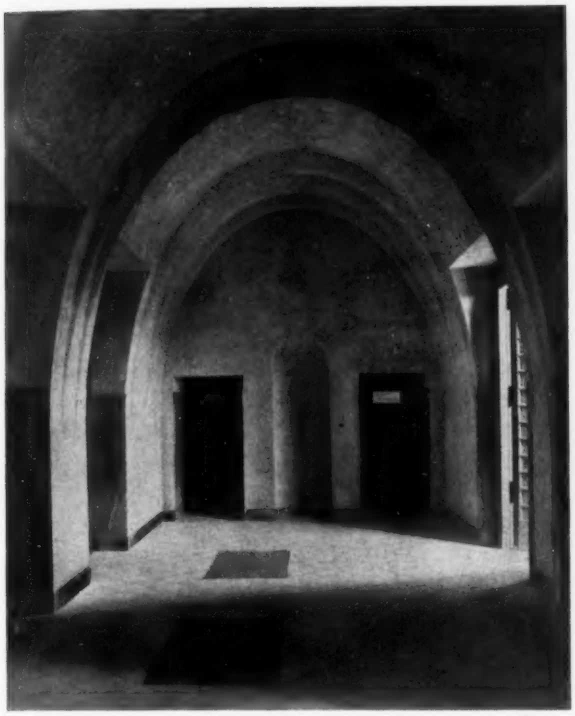
SIDE CHAPEL

Pallotiner Church, Limburg
J. H. Pinand, Architect

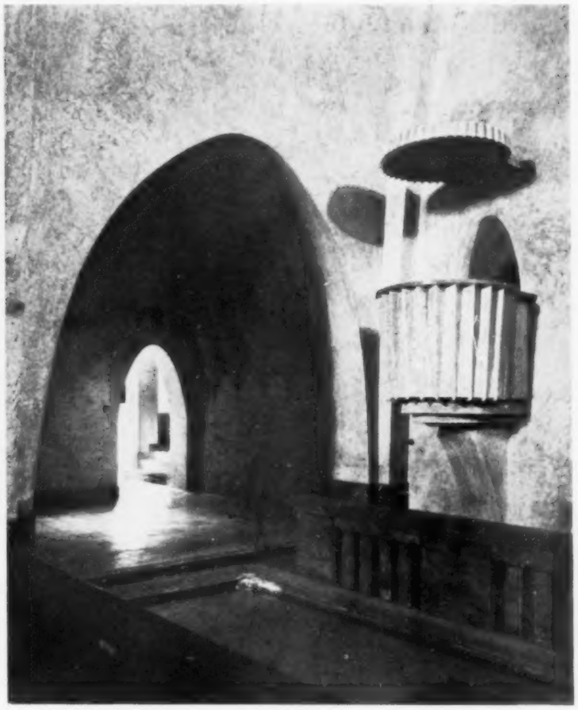
bolic churches of Professors Bohm and Pinand could have been as light as those of Perret had they chosen to use this type. The administration building of the J. G. Farbenindustrie, in Hochst-on-the-Main, Germany, is connected with the rest of the plant by a parabolic street bridge; this arch is echoed in the tower windows as well as in the third story fenestration which shows that Professor Peter Behrens appreciates the value of the parabola. The most remarkable recent use of a parabolic vault is shown in the Pallotiner church in Limburg-on-the-Lahnriver, Germany. That this modern structure is a church for orthodox, conservative Catholics is one of the anomalies of which our present age possesses so many. It marks its designer, J. H. Pinand as one of the foremost architects of our generation.

Maybe the reader resents the word "modern" when used by architects as much as does the writer. Mr. Cram, with partly justified abhorrence, lashed modernism in the September issue of the *Journal of the A.I.A.* and gave ferro-concrete a few blows which the author of "The Ferro Concrete Style" cannot leave unanswered. There exist as many modern styles as there exist modern architects, and all the excitement is caused by the fatal habit of generalizing. In politics the same mistake is often made; one says: "The French do this and that, the Germans are so and so," which prompts the question, "Do you mean the royalist, Daudet, or the socialist, Jean Jaures, or Mr. Coue, when you speak of the French?" So before discussing modernistic architecture, one must first agree on which variety of modernism is being debated. Just as the progressive, republican Germans and the reactionary, war-loving German *Hakenkreuzler* hate one another much more than the Germans ever hated the French, so among modern architects there are wider chasms than there are between certain types of modern design and historical precedent. The churches of Professor Bohm and J. H. Pinand may be considered more closely related to Gothic tradition than to some of the angular barns considered modern churches by many contemporary architects.

One can divide modern art into two distinct groups. One group is decadent, with "artists" who mock the public by purposely disobeying all laws of beauty, hoping to win publicity and money by their monstrosities; some of this decadent group may be sincere, but mentally diseased. This decadent group is more represented in painting than in architecture, since architecture is protected by the laws of statics, building codes and the demands of people who intend to use the buildings. The distorted features of some "modern" portraits and the convulsions into which their painters torture the human form prove that these paintings are the product of insanity. Actually, inmates of insane asylums have defiled canvases in so similar a manner that they could be exhibited in a salon of "modernists." Modernists of the second group are full of the artistic expression of a new age and a new religion; they too are no longer



LOBBY



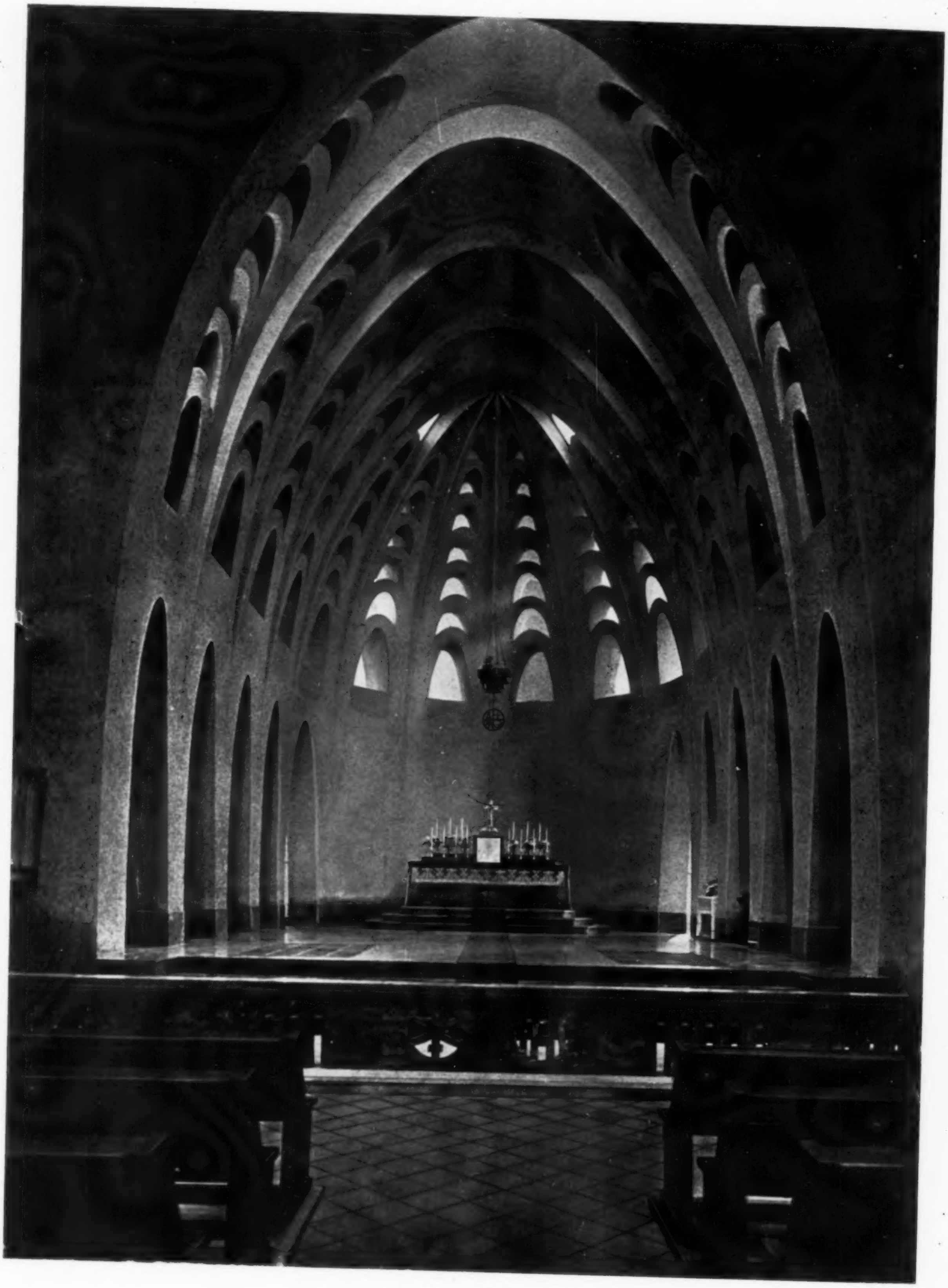
PULPIT

Pallotiner Church, Limburg
J. H. Pinand, Architect

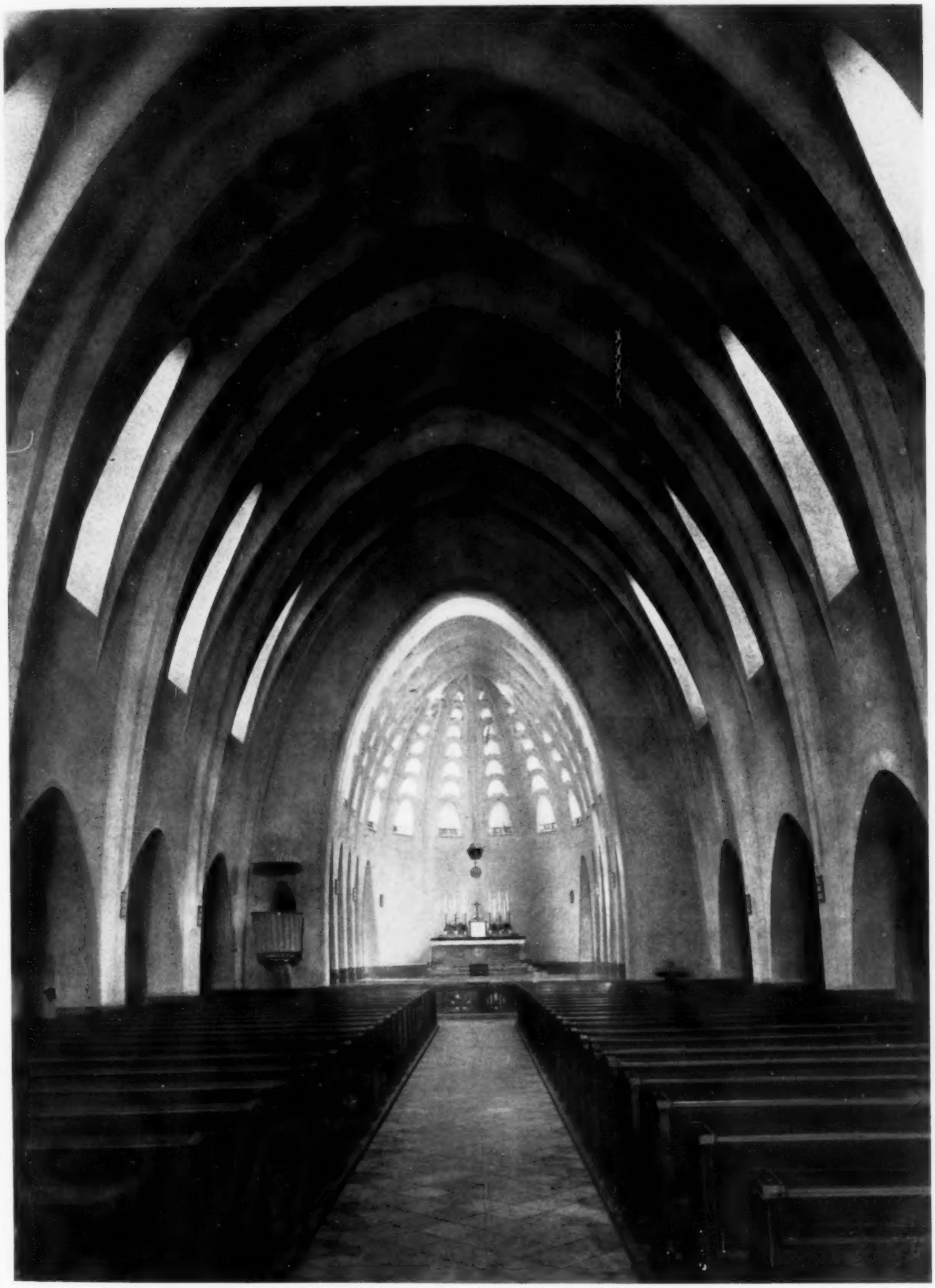
using traditional forms, but they are putting their best logic and sentiment into their creations. These have sometimes a primitive, crude expression, for naturally pioneers err from the right trail at times. Striving to find new symbols for their new messages, their utterings may sometimes be mistaken for those of decadent bluffers and lunatics. But as a rule health and truth are discernible in the embryo of the New Age style and distinguish it very definitely from the stench of the corpse of a decadent, immoral, aimless culture. Mr. Cram has made the mistake of throwing these two very different kinds of modern style on one pile, inviting us to burn the whole as rubbish. Let us rather remember Christ's parable of the wheat and the tares, which is full of significance.

Mr. Cram amplified his article "On Decadence in the Arts of France" with some illustrations, among which were the Le Raincy and Montmagny churches of the Perret brothers. Yet they belong to the second, healthy class of modern architecture and develop the Gothic tradition of making the church a colored lantern by having the entire walls grilles framing pieces of colored glass. How then can Mr. Cram claim that the designers "ignored all considerations of the Catholic religion as such . . . rejected all the canons of beauty as these had existed for three thousand years . . . "? What would Mr. Cram have done with only $30,000,—the price of Le Raincy,—at his disposal? Perret's churches are crude and bear the stamp of hasty construction,—but they have the beauty which intelligence dominating dull matter always produces. An example of the decadent school in modern architecture is the barn-like *Goethaneum* in Dornach, Switzerland, which deserves all the disdain which Mr. Cram heaps on the ferro-concrete style as a whole (whereby he denies its very existence).

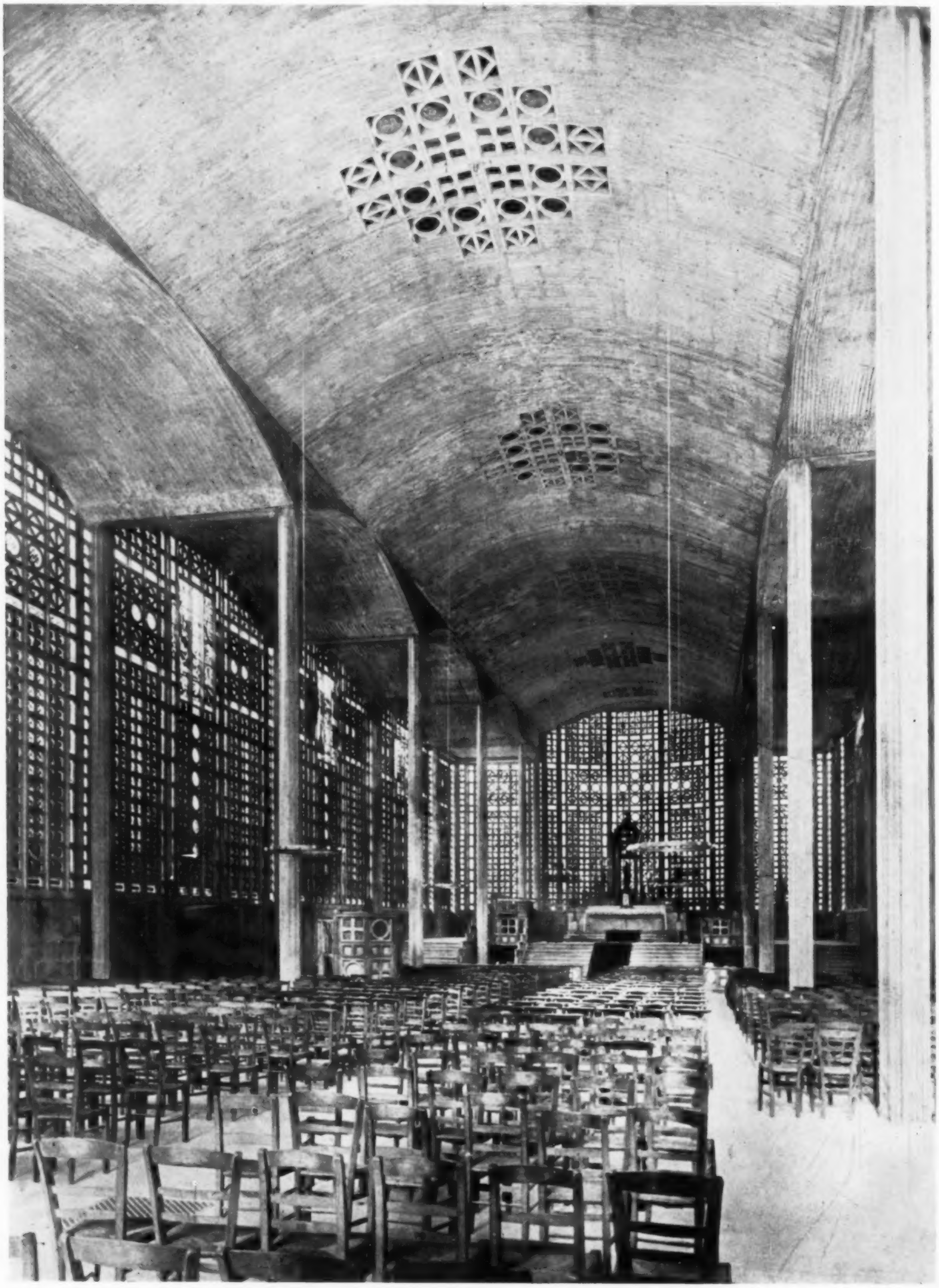
Professor Bohm's parabolically vaulted Bischofsheim church possesses the advantage over the Perret type in that it made the curved form supreme. The angularity which conservatives dislike characterizes the "wood-centering style," the earliest, most primitive stage of ferro-concrete building, in which the wooden forms but not the liquid contents were expressed. "Liquid stone," as the name implies, is better suited to curved forms than any other structural material, and as soon as the designer realizes that concrete can be formed with self-centering metal lath, with curved metal forms or with very thin, bendable wooden boards, he will rid himself of the now prevailing idea that concrete demands angular shapes and straight planes. Unquestionably, Perret's designs are too much dominated by angularity; but they stress concrete tracery, use of which is one of the main characteristics of the perfected ferro-concrete style; the large amount of light introduced into Perret's churches, and the wonderful display of color they permit, present advantages which the Catholic church in Bischofsheim lacks; the latter has a crypt-like aspect due to its narrow windows, which belong in the Romanesque period.



CHANCEL
PALLOTINER CHURCH, LIMBURG
J. H. PINAND, ARCHITECT

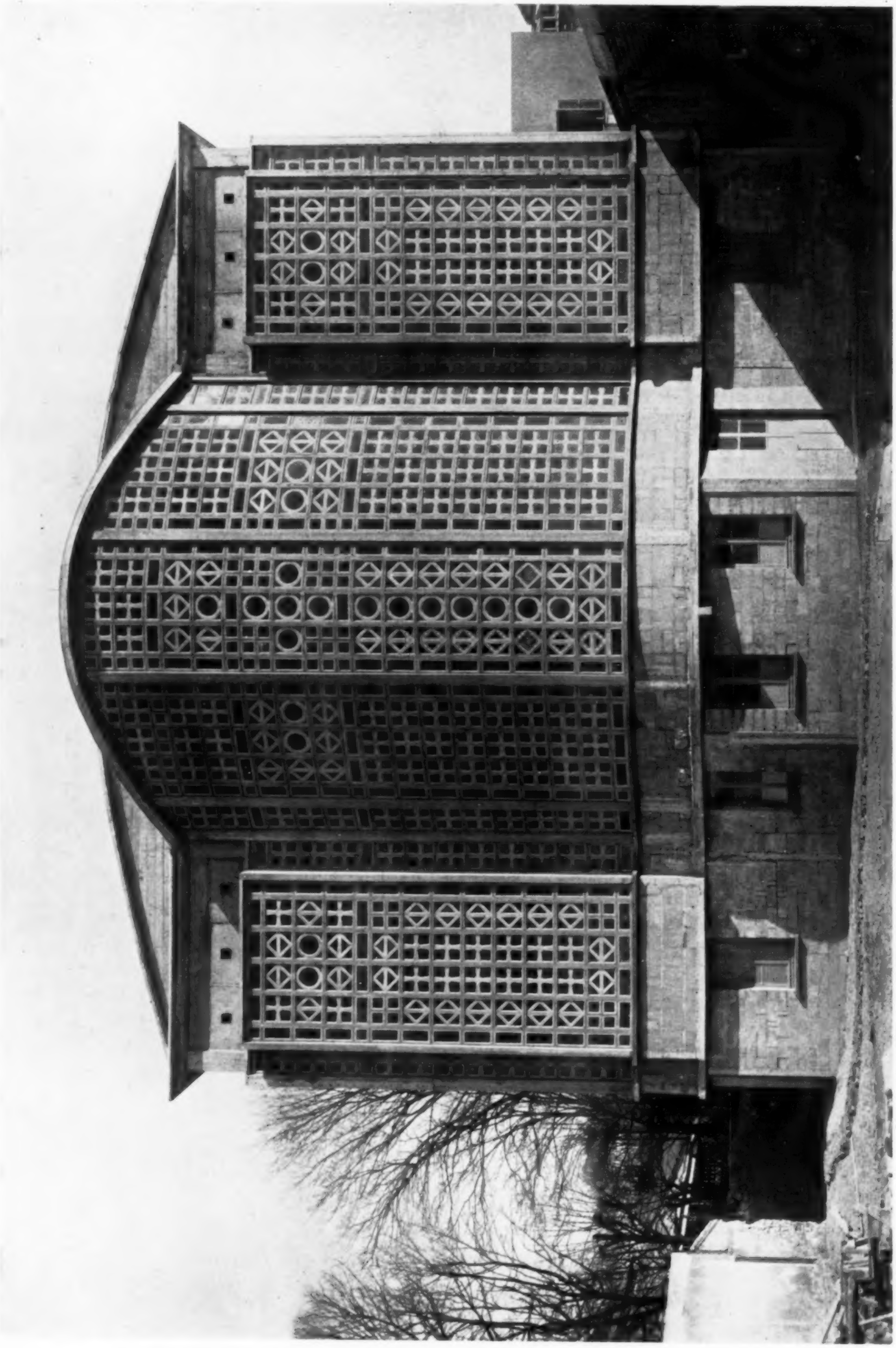


GENERAL VIEW OF INTERIOR
PALLOTINER CHURCH, LIMBURG
J. H. PINAND, ARCHITECT

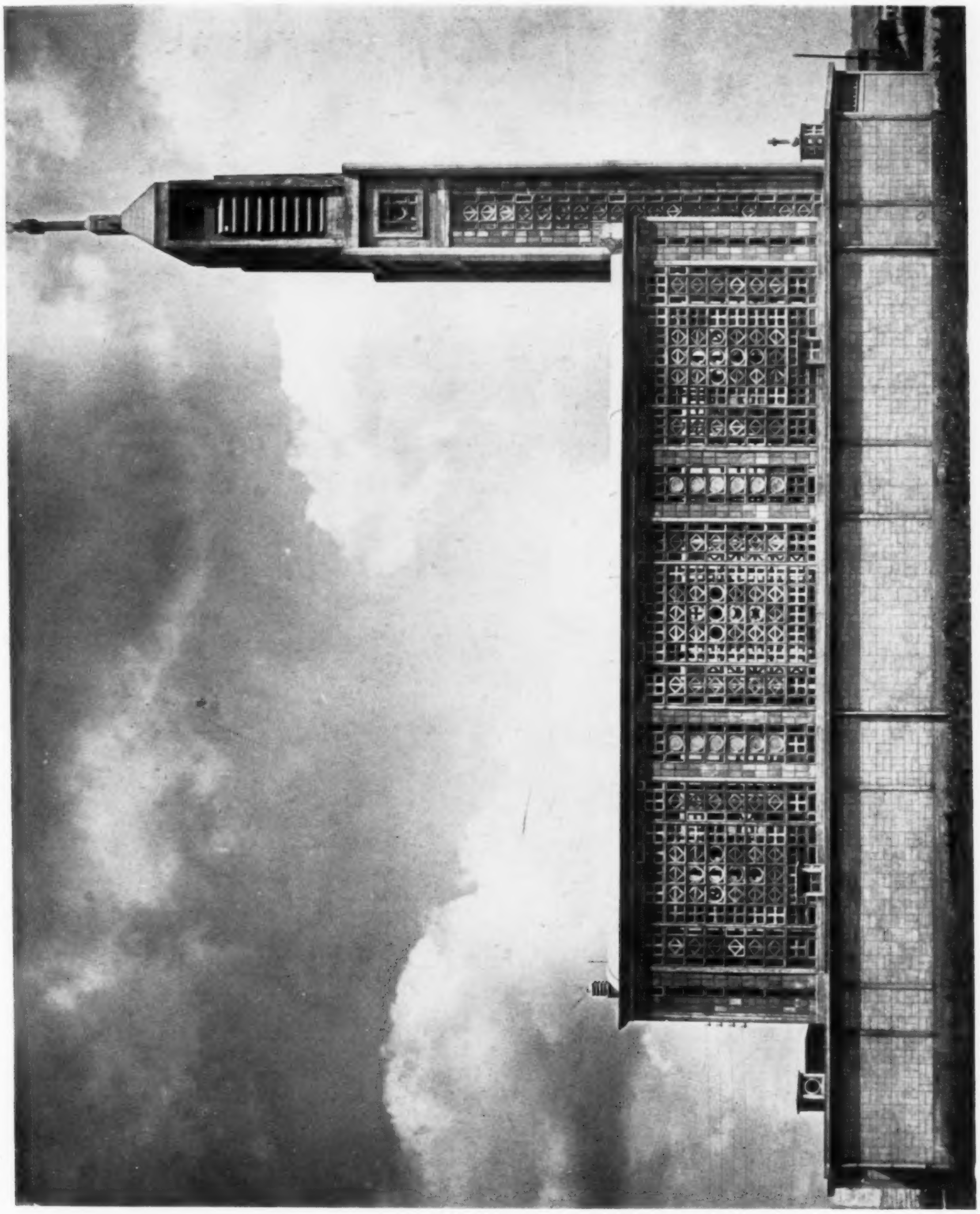


INTERIOR
CHURCH OF NOTRE DAME, LE RAINCY
A. & G. PERRET, ARCHITECTS

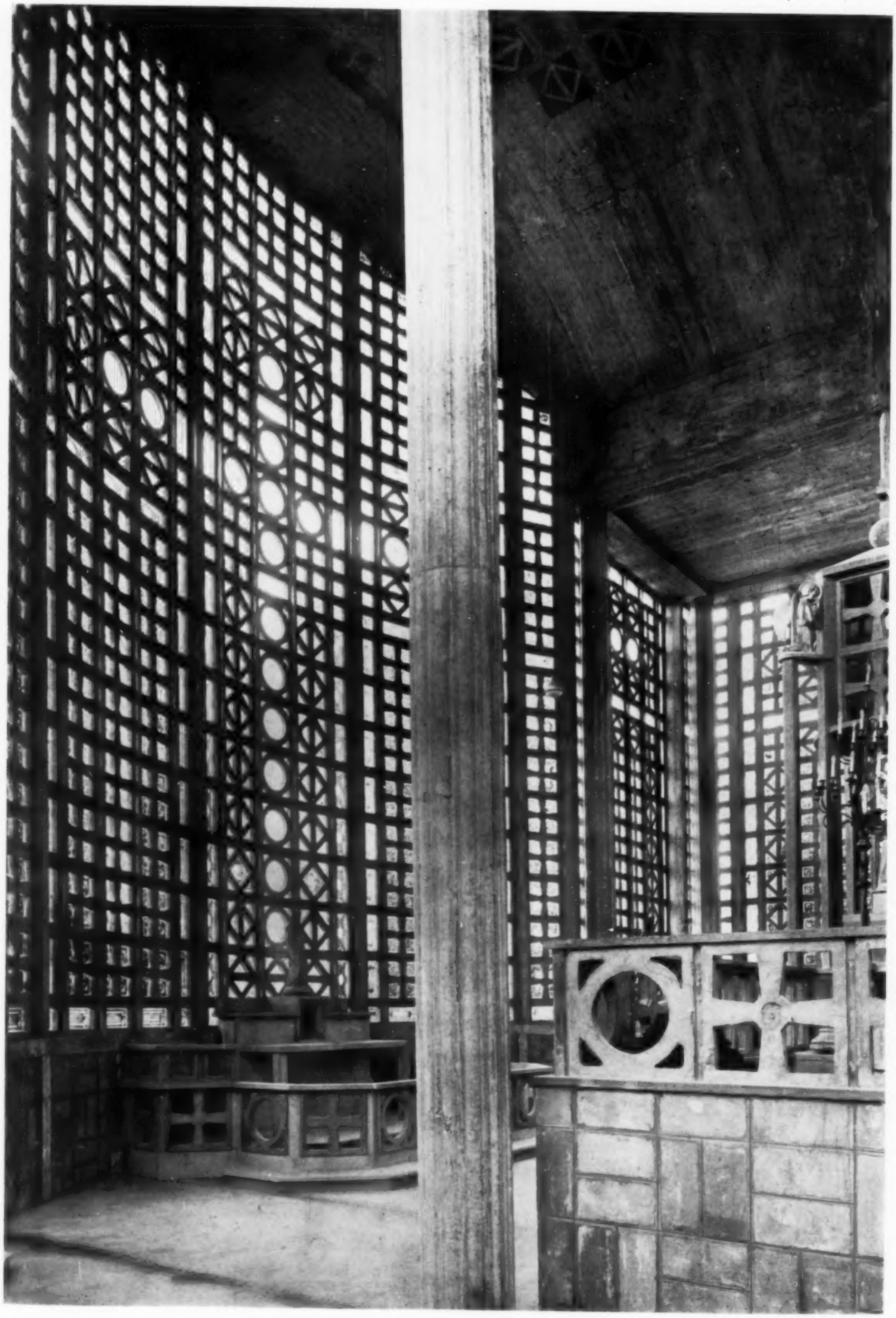
EXTERIOR
CHURCH OF NOTRE DAME, LE RAINCY
A. & G. PERRET, ARCHITECTS



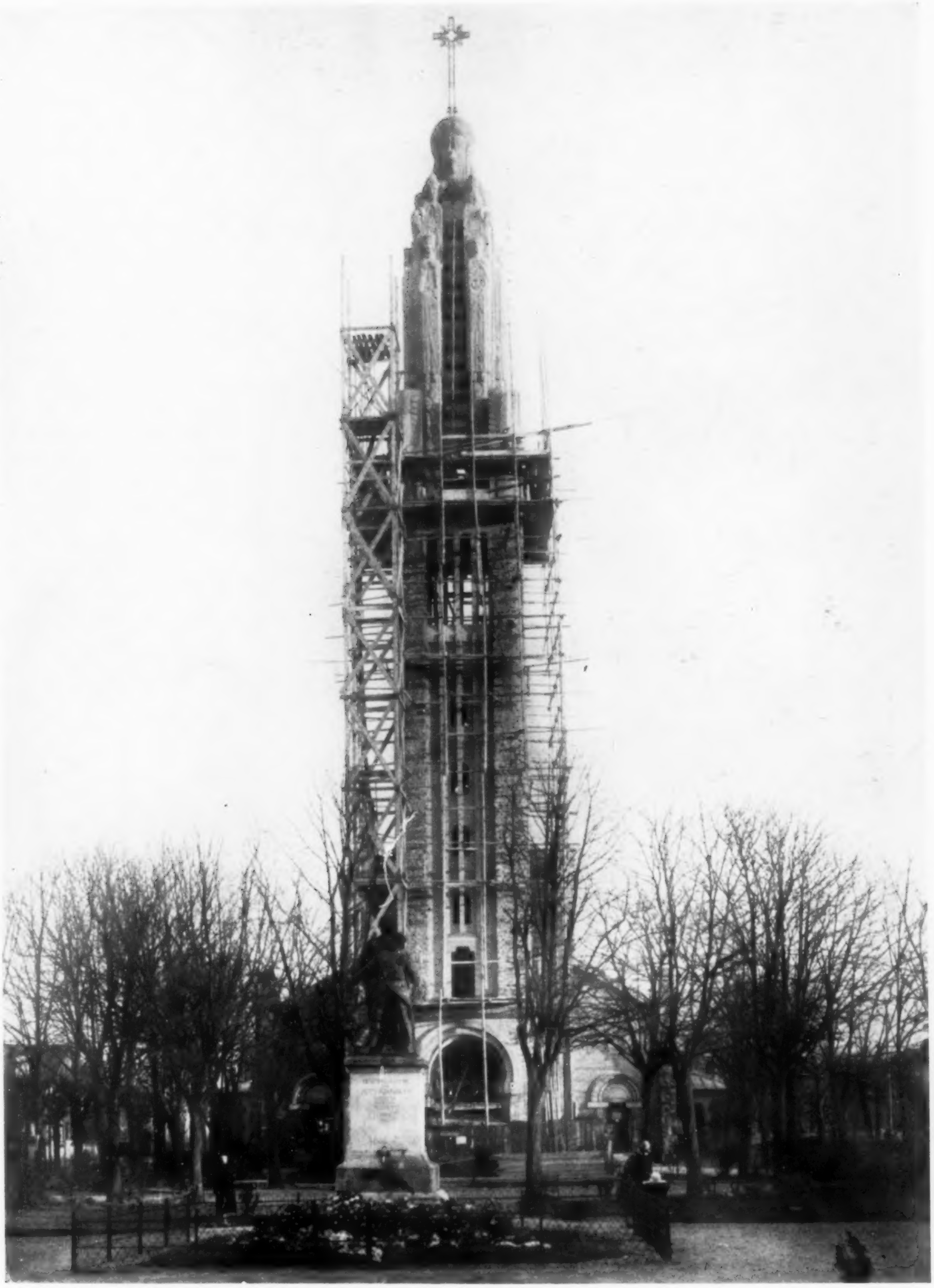
VIEW FROM EAST, CHURCH OF NOTRE DAME, LE RAINCY
A. & G. PERRET, ARCHITECTS



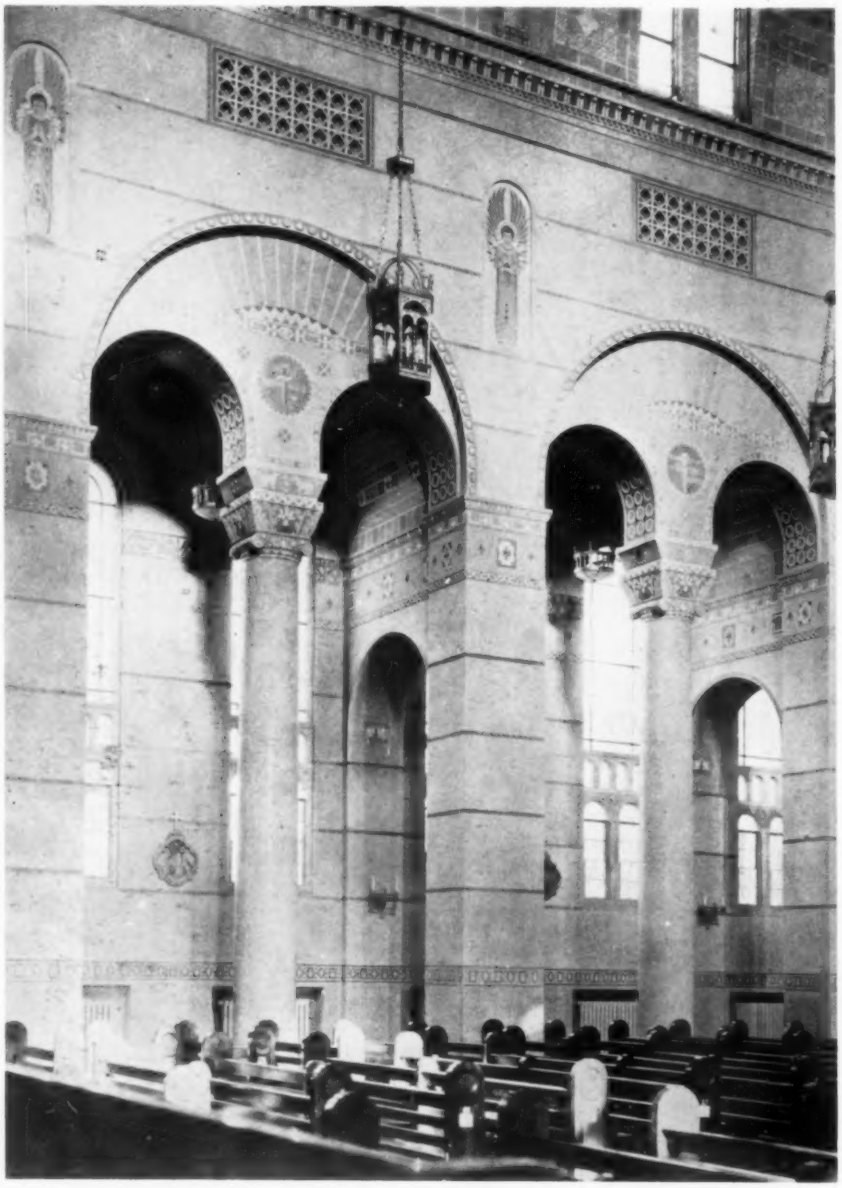
NORTH ELEVATION
CHURCH OF ST. THERESE, MONTMAGNY
A. & G. PERRET, ARCHITECTS



DETAIL OF APSE
CHURCH OF NOTRE DAME, LE RAINCY
A. & G. PERRET, ARCHITECTS



FERRO CONCRETE CHURCH OF ST. LOUIS, VILLEMONBLE
PAUL TOURNON, ARCHITECT
SARREBEOLLES, SCULPTOR



Interior, Church of the Sacred Heart, Washington

parabolically arched windows convey a rhythm and elasticity that suggest sprays of water whirling out of a fountain at different levels, following parabolas as they mount and fall, obeying the recognized laws of gravity.

These parabolic arches are examples of concrete tracery as understood in the broadest sense. Semi-traditional concrete tracery is visible in the side chapels shown on page 178. Tracery is not yet understood as well by Pinand as by Perret, for only the latter replaces all walls by grilles. In the combination of parabolic arches and modest tracery application the Pallotiner church is closer to the perfected type than either Perret's building or Professor Bohm's churches. Professor Wienkoop, director of the Darmstadt Architectural School, in writing of the Pallotiner church, speaks of revelations in the design of churches made during the last two or three years (especially of Catholic churches). He condemns churches built in the new style of Le Corbusier and approves of those which, like the Pallotiner church, show the architect's understanding of religion, ". . . his having grasped cosmic universality as a completed whole . . . primeval-eternal experiencing of the harmony of all visible and invisible . . . it is more than an attempt; I consider it an epochal step in the evolution of modern church design . . ; nowhere is there a harshness which forces the eye to halt. Thus it vibrates in spiral lines toward the center and is captivated, bodily and spiritually, by the vision point of the altar. The church is connected with a monastery, and hence the ten chapel-like niches which replace the customary aisles. . . . Courage was needed to arrange the lighting of the nave by narrow windows which are hidden from view on the interior by very deep reveals."

The highest type of church of the ferro-concrete style will combine two features. Space will

Yet we must be grateful to both of these designers, for each has materialized one outstanding feature distinguishing the ferro-concrete style.

J. H. Pinand's church better illustrates use of the perfected ferro-concrete type than does Professor Bohm's in that not only is the nave a parabolic vault but also the windows and the arches supporting the cloister roof are parabolic. It admits more light and is not as oppressive as the Bischofsheim church, due to its parabolic clerestory windows. It is to be regretted that each church masks a novel interior in a more or less Romanesque exterior in which a few pointed arches occur. The most delightful part is the choir, a "lantern" in which successive tiers of

be enclosed by a parabolic vault in which walls and roof will merge into each other. All apertures will be covered by parabolic arches. Concrete tracery will make up all surfaces, but it will not consist of the simple geometrical shapes employed by Perret; rather it will have pictorial content produced by the silhouette effect of the concrete backed by interstices. A variation of this type will maybe have a parabolic plan, with the pulpit placed at the focus. Designs of this type of auditorium were submitted for the League of Nations Palace competition. The ramped floor of Notre Dame, Le Raincy presages that the future type may have a curved floor.

As the significance of the parabolic arch was described in a former article, pictorial concrete tracery will now be defined. Frank Lloyd Wright has built several residences in California, some of which are so adorned. These ornamental voids give a decorative effect from without as well as from within. Since the ancient days in which the first true arch was constructed, nothing more revolutionary than the tracery walls of Perret and the pierced tapestry walls of Frank Lloyd Wright has been created. And yet these are mere beginnings; the surfaces of the perfected ferro-concrete church will represent the parables of Christ, and symbolic figures in concrete will be silhouetted against stained glass. The term "tracery" may be misleading for this new type of wall treatment, as it will in no way resemble the tracery of historic styles. The concrete framework of arches (piers) and girders which form the skeleton will become veritable frames for pictures and ornaments wrought in concrete tracery. Gothic tracery bars were limited in thinness; reinforcement by aluminum wire will make possible creation of very thin rods in concrete tracery. Gothic tracery partly served to strengthen the window panes; in concrete tracery this will be of only secondary importance since the new tracery will act as bracing for the bearing members. The reinforcement will tie concrete tracery and structural frame into one,—will make the entire wall a rigid unit pierced by holes,—holes that tell a story.

Figures on Church of St. Louis, Villemonble

The modern architect must take the psychology of our present-day life into account. Hundreds of impressions, electric signs and glaring displays enter our vision, and motion pictures bring our nerves to a tense pitch. The ornament and the bas-relief sculpture of traditional type cast too pale shadows and remain unnoticed. John Ruskin's contention that the power of architecture depends on the quantity of its shadow is very true.

Figures on Church of St. Louis, Villemonble

Concrete tracery will cut out the shadows and provide the high lights which we need in our temperate zone. We need so much window area to admit sufficient light that, in order to provide some restful wall space, the architect must leave the remaining areas undecorated and use the window with its deep shadow and clear outline as a motif. The curvilinear windows in the church at Ulm are a step in the direction of this development. As concrete will harden into any form into which it is poured, it is no longer natural or necessary to have vertical contours for all openings. Bricks, wood, and steel beams are straight elements, and therefore it has been natural to have windows and doors as well as other parts of design rectangular, since introduction of curves necessitated extra cost. In concrete design, curvilinear outlines must become usual, as they are more beautiful. These curtain walls resemble in their function the tympanum of the classical temple and the metopes of Doric friezes; we therefore would be following tradition in covering our concrete wall panels with pictorial tracery. Only a few of the glass panes need be made movable.

As Goethe recognized, evolution follows a spiral curve, returning after a cycle to the starting point, but on a higher level. Use of concrete tracery harks back to the Egyptian tradition of scratching pictures on the early mud or plastered walls. Concrete walls have two points in common with the ancient mud walls of Egypt,—plasticity before setting and the possibility of avoiding projections,—with concrete, a matter of economical centering. On the other hand, ferro-concrete is hard and can carry tension; therefore it can be pierced, and it permits the creation of pictorial silhouettes which are more effective than the incised outlines of wall sculpture as known to Egypt.

Use of concrete tracery will help the architect to fulfill once more his supreme duty,—to create poetry and tell stories in stone,—and to be heard. Concrete tracery with its black and white, eventually even with color, will convey the architect's message, and in a way to compete successfully for attention with the advertisements which are the most conspicuous features of our streets. The true artist always has a message, and concrete tracery will be an effective medium for proclaiming it. The thoughtful architect will have to agree with Ruskin in affirming that the rudest work telling a story or recording a fact is preferable to the richest without meaning.

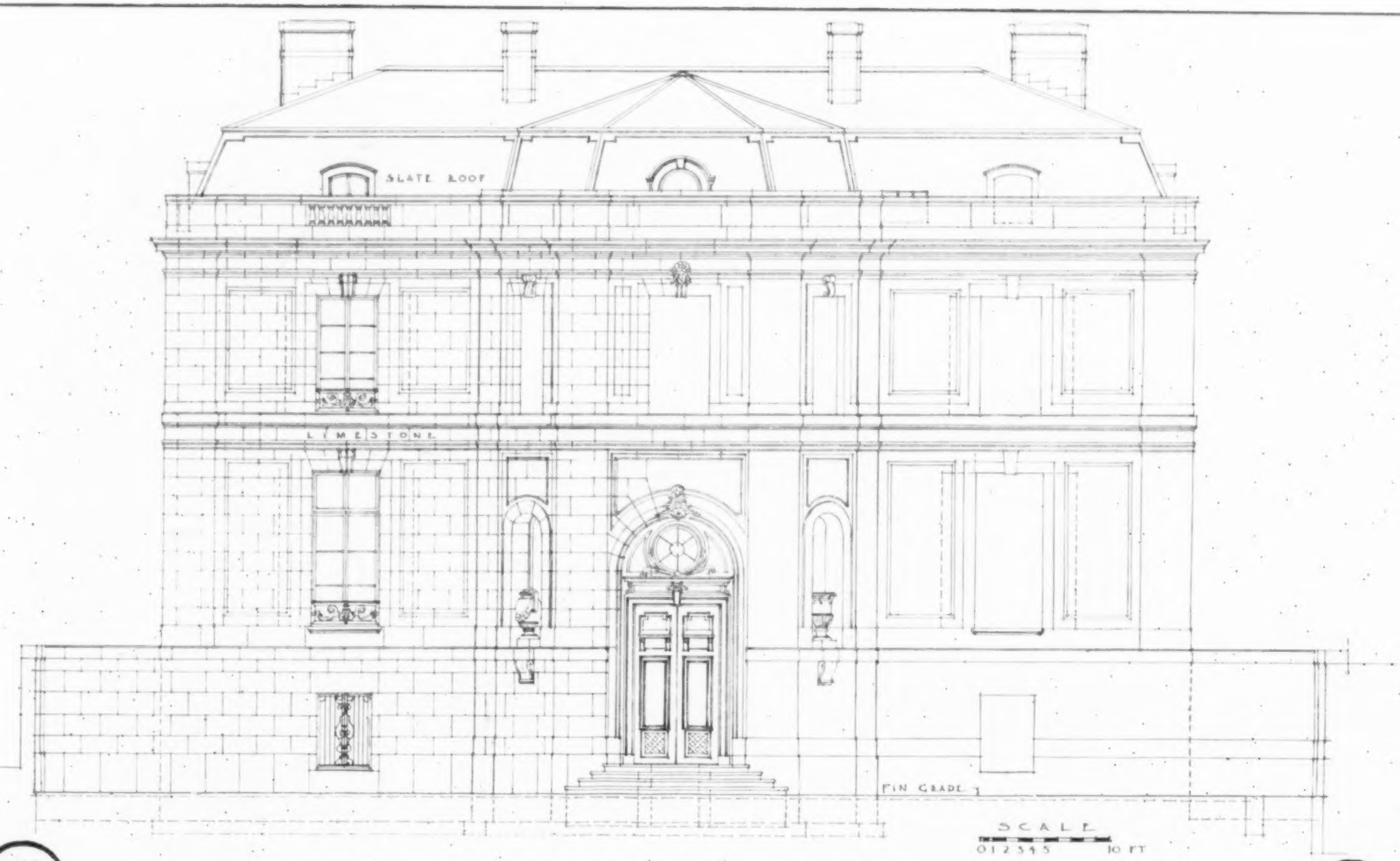
In case bas-relief as an addition to the simple silhouette effect,—light concrete on dark window glass by day, dark concrete on lit-up window glass at night,—is desired, the sculptor could chisel before the concrete is hard, or without difficulty moulds could be inserted in the main centering.

Photos. Drix Duryea

Details on Back

"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

UNIV. OF MICH.



AUG. 1929

FRONT ELEVATION

DETAIL, "MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

No. 4

The Architectural Forum Details

Detail on Back

MAIN ENTRANCE

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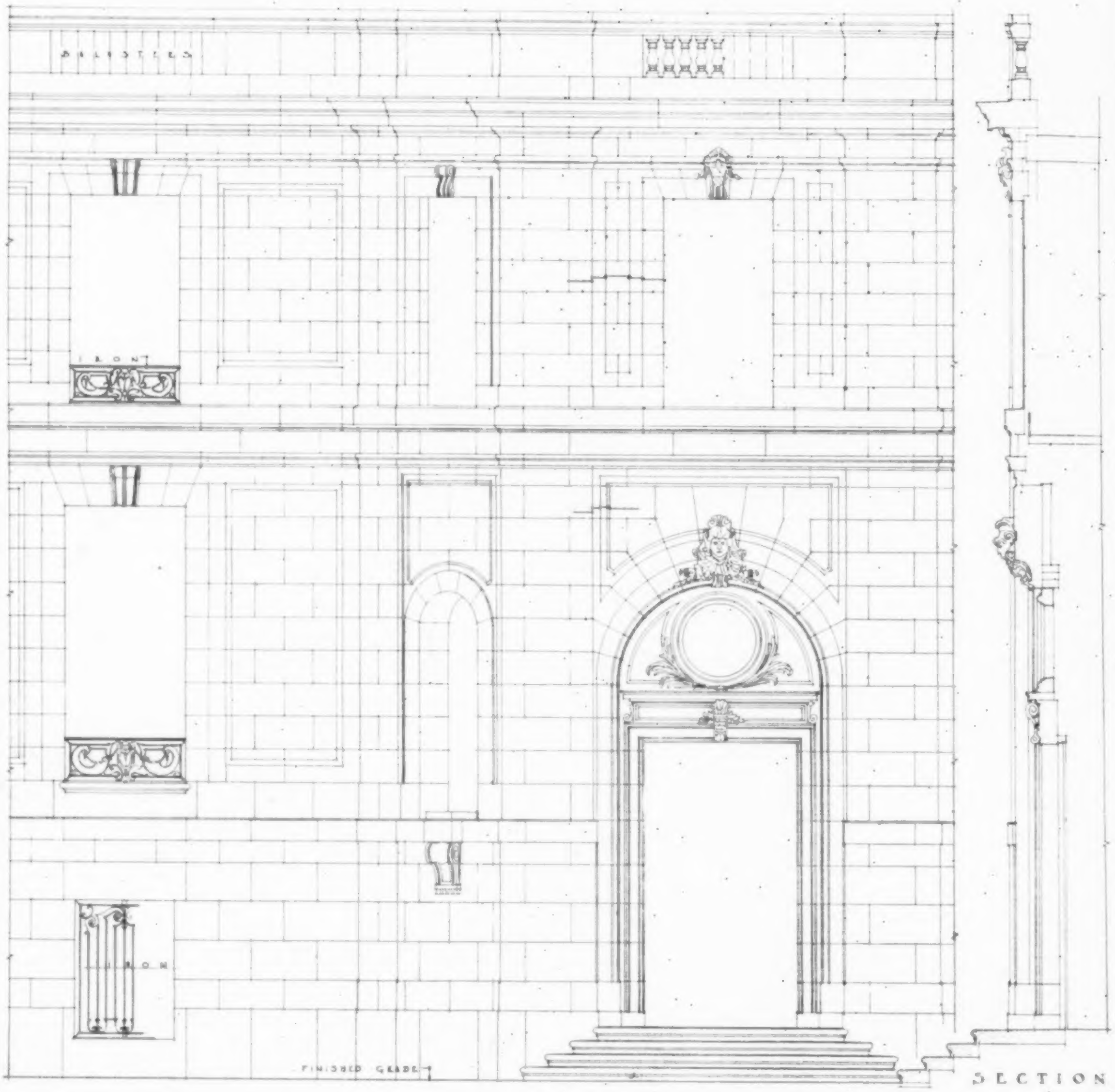

AUG. 1929

EXTERIOR STONE DETAIL

SCALE 0 1 2 3 4 5 FT.

No. 5

DETAIL, "MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
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The ARCHITECTURAL FORUM DETAILS

Plans on Back

VIEW FROM DINING ROOM THROUGH LOGGIA INTO DRAWING ROOM
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
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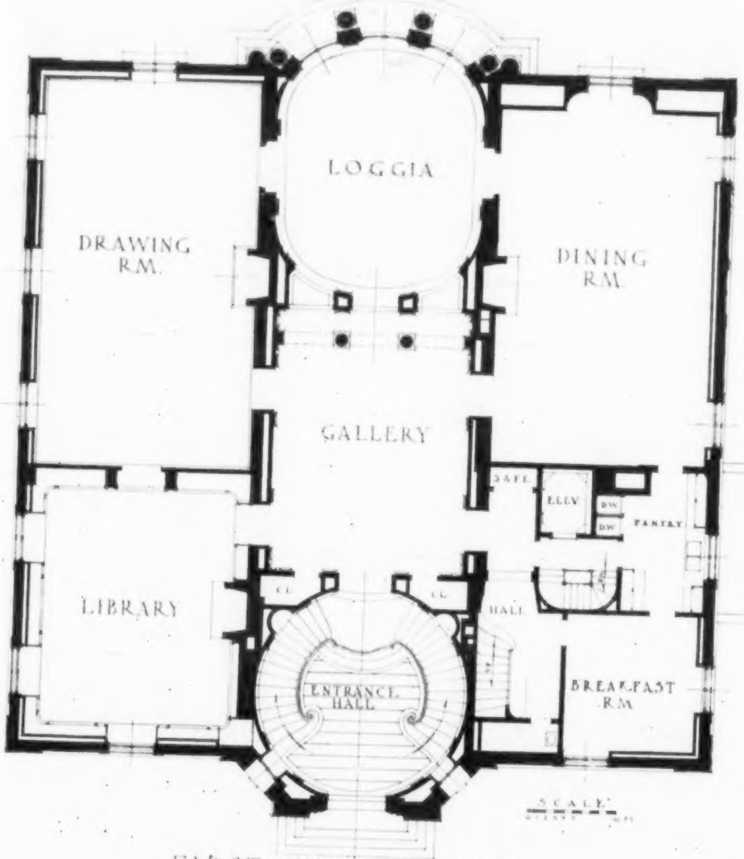
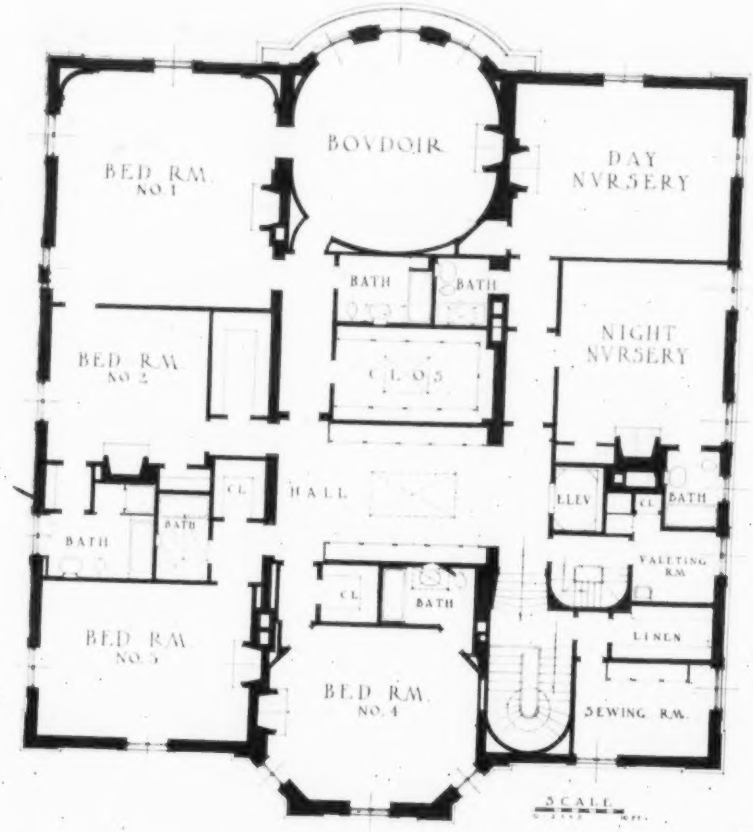


FIRST FLOOR PLAN



SECOND FLOOR PLAN

PLANS, "MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

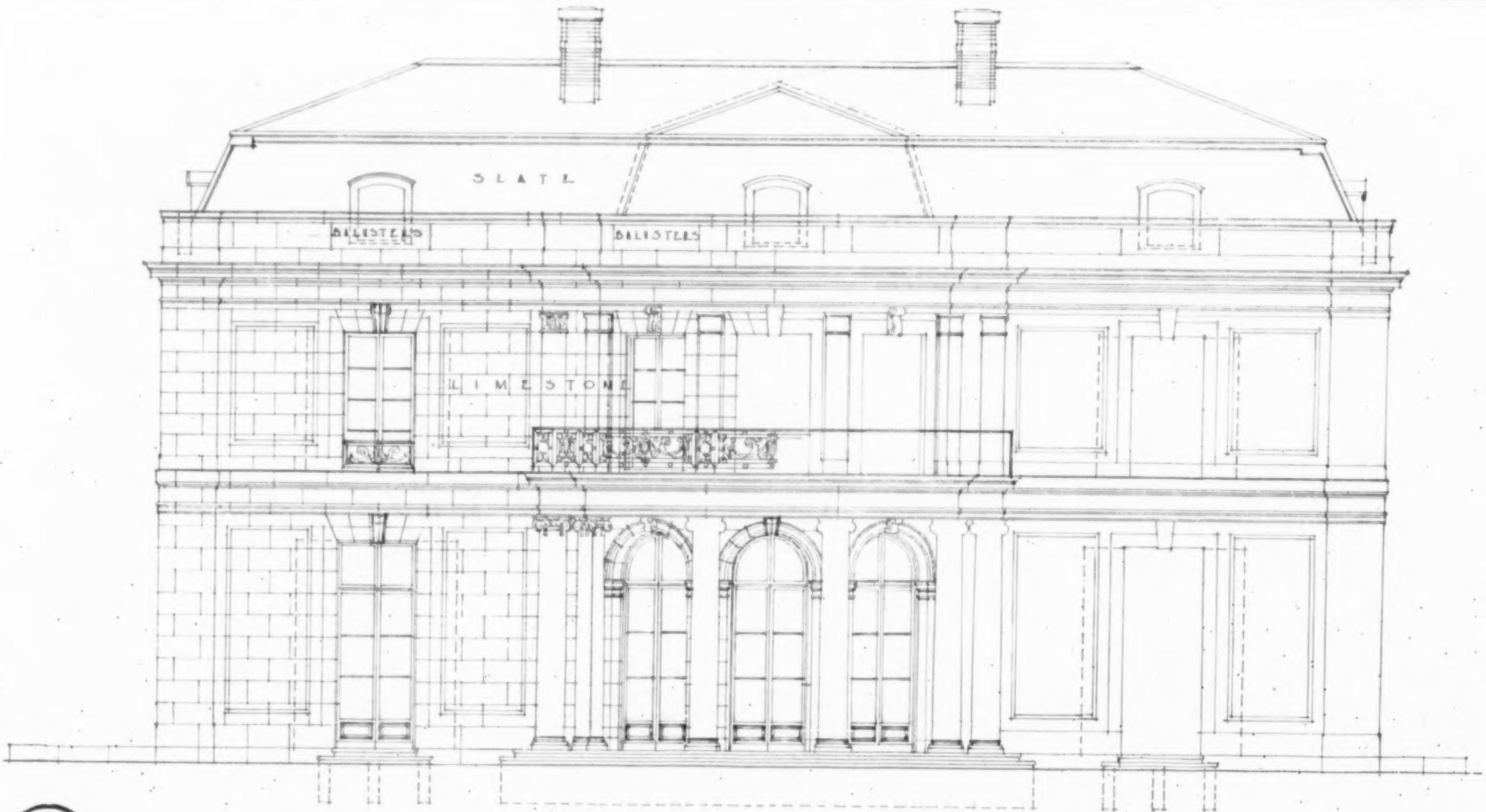
VIEW FROM GALLERY INTO LOGGIA
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

Details on Back

LOGGIA

"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON

OFFICE OF JOHN RUSSELL POPE, ARCHITECT



AUG. 1929

GARDEN ELEVATION

DETAIL, "MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON

OFFICE OF JOHN RUSSELL POPE, ARCHITECT

No. 6

The Architectural Forum Details

LOGGIA
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
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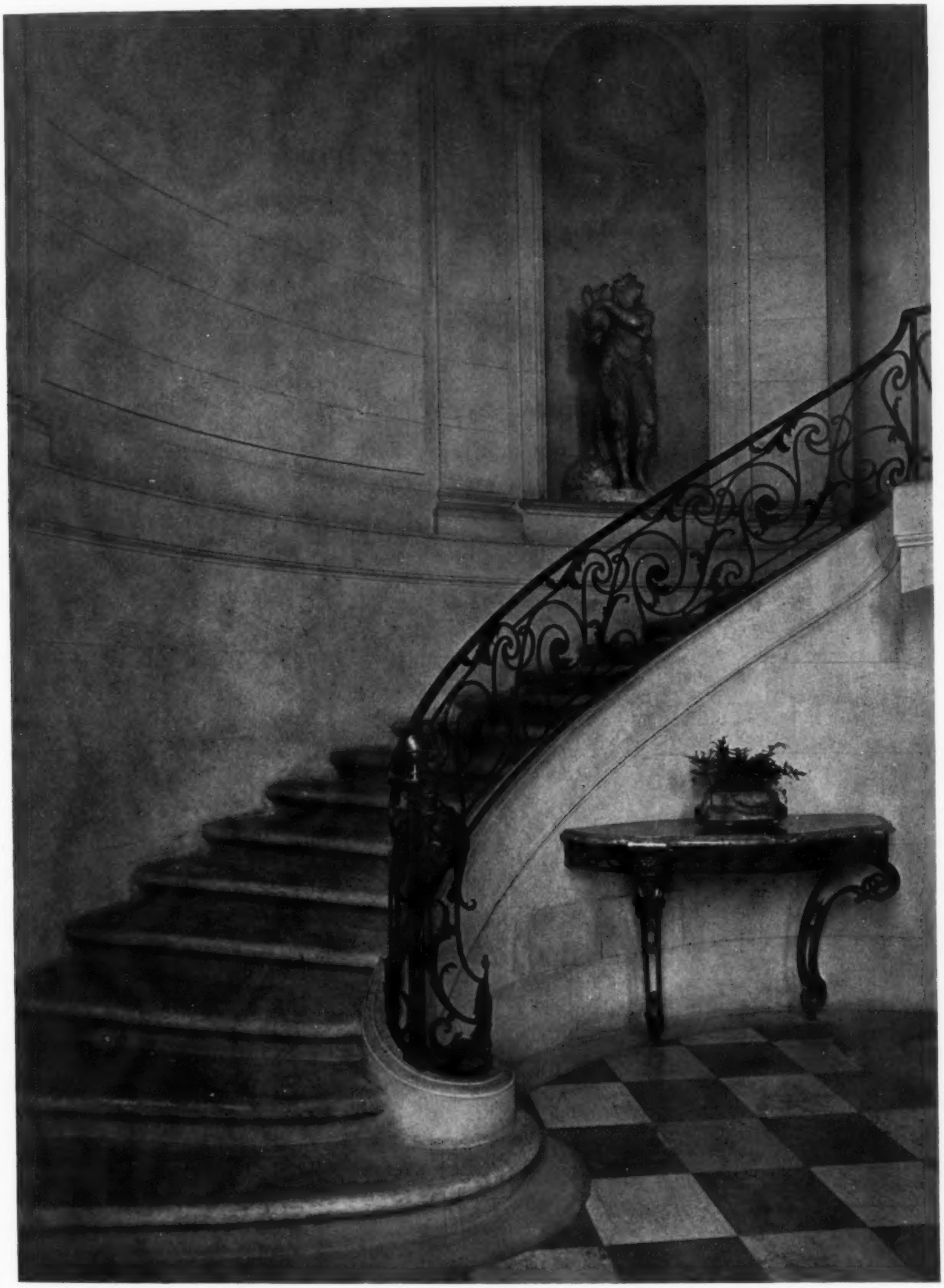

MAIN STAIRWAY
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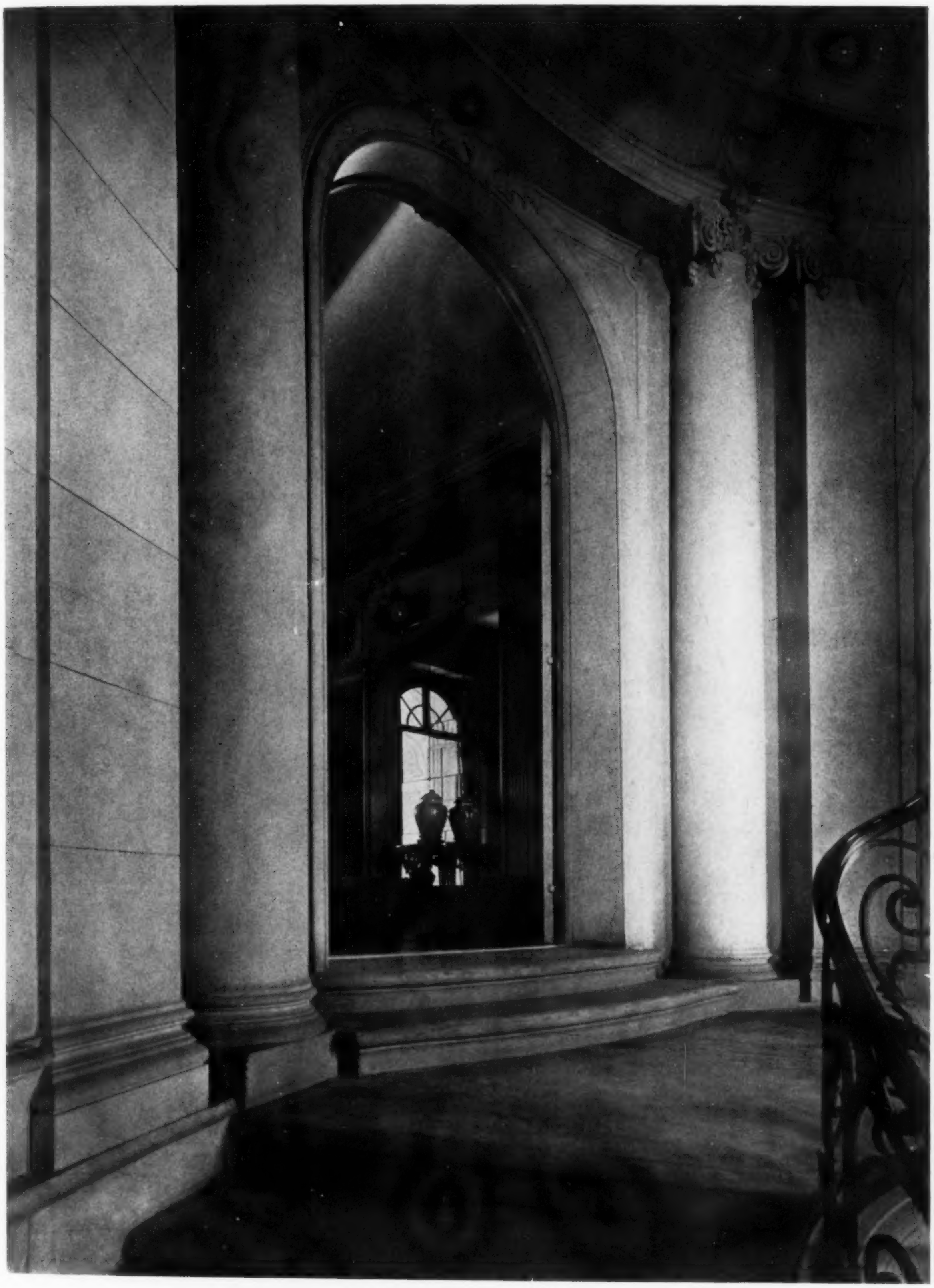

MAIN STAIRWAY LANDING
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
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VIEW FROM DINING ROOM THROUGH GALLERY INTO DRAWING ROOM
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

GALLERY
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

TWO VIEWS OF THE DRAWING ROOM
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

DRAWING ROOM
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
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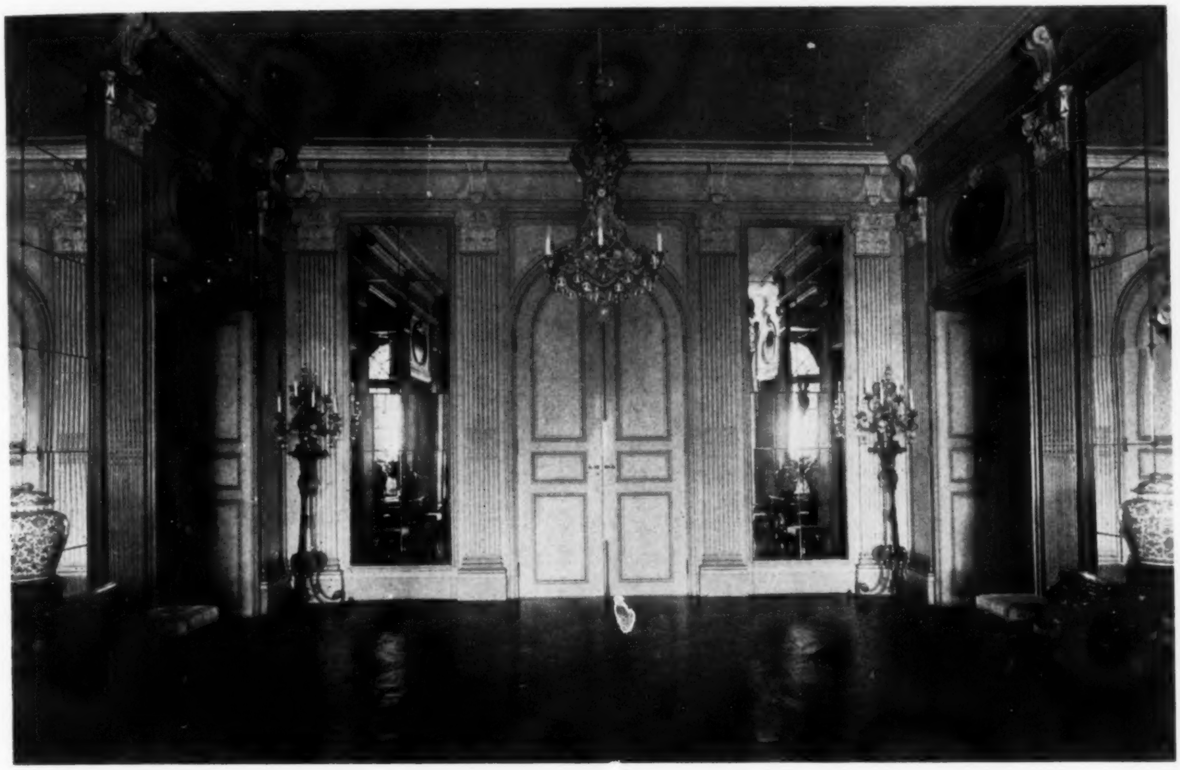

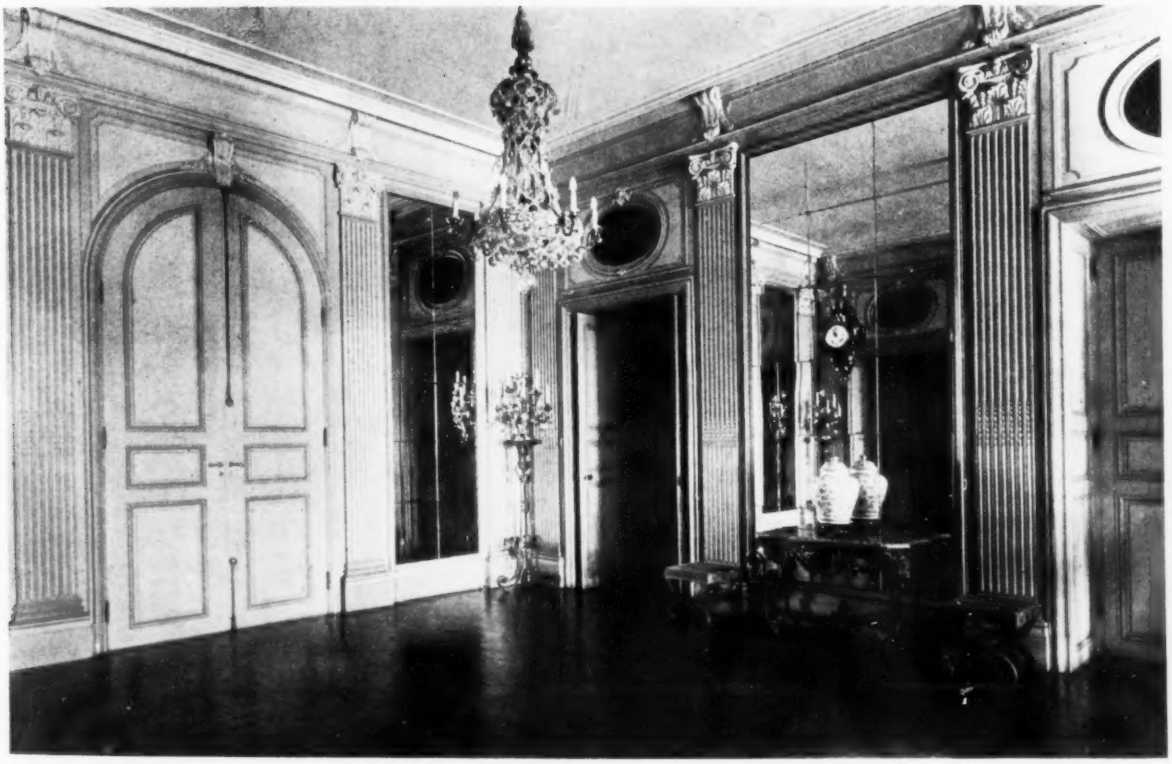

TWO VIEWS OF THE GALLERY
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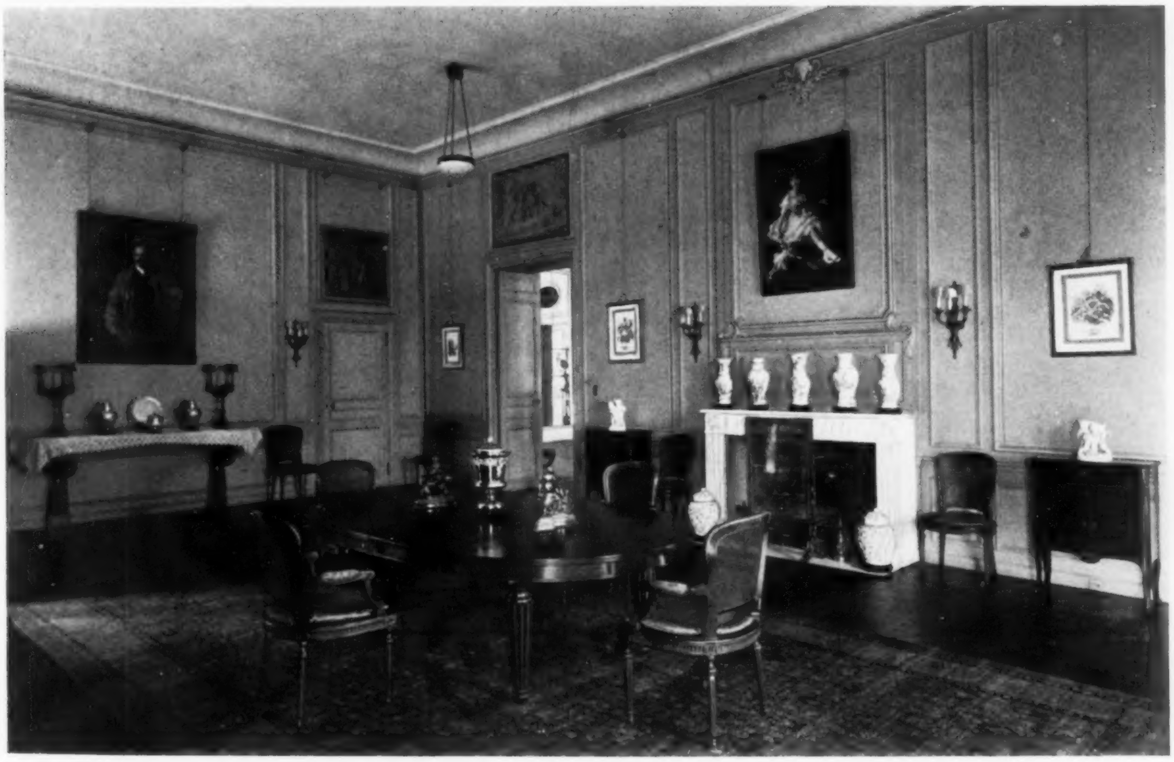

TWO VIEWS OF DINING ROOM
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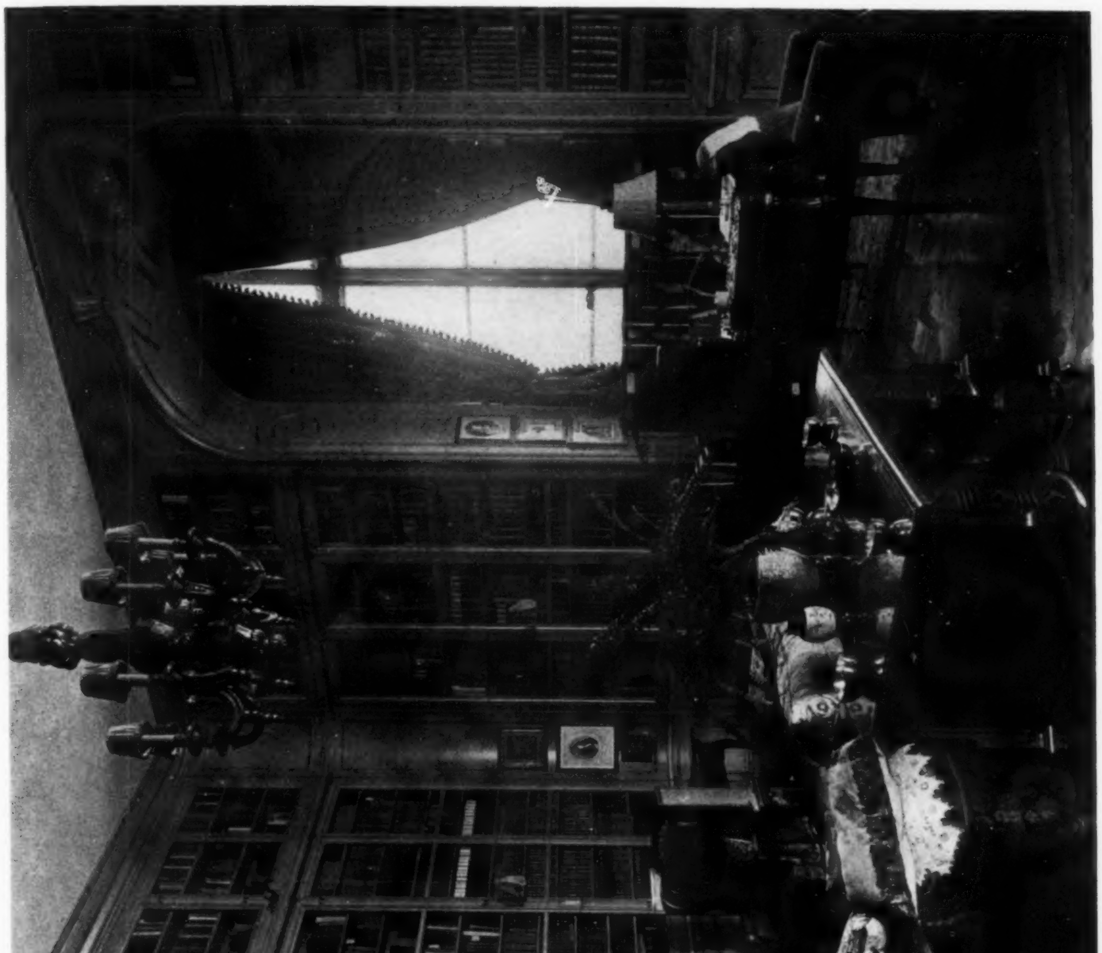

LIBRARY
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

UNIV OF MICH

LIBRARY
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
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"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON

BY

MATLACK PRICE

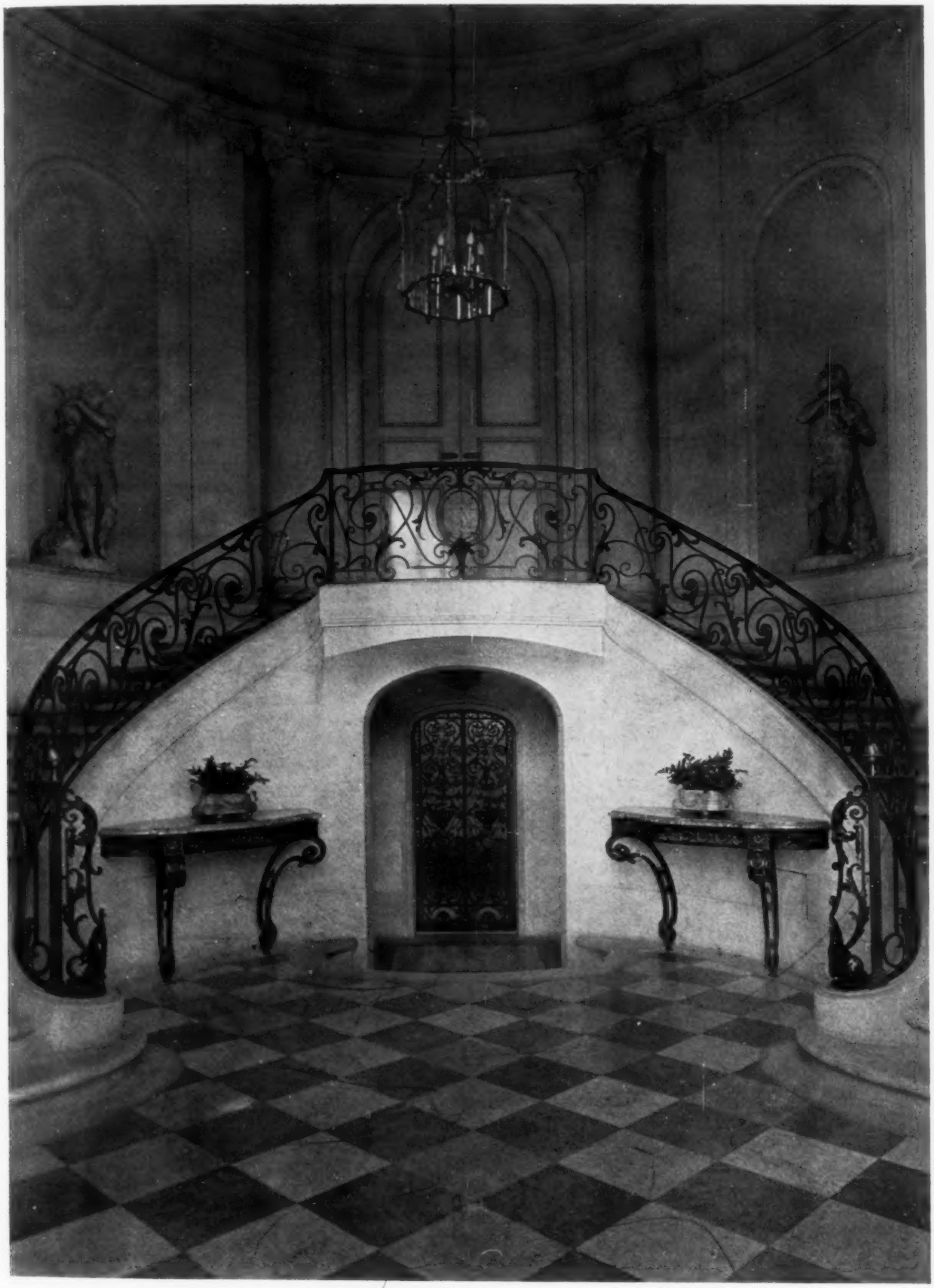
NOW that much of the architectural thought of this country is preoccupied with new architectural ideas, with expressions variously called "modern" or twentieth century, it may well be that we shall set up new standards in our renderings of historic styles. Such new standards would, necessarily, have to do with degrees of perfection. Ever since it became the architectural fashion to adapt European styles, this has been done very thoroughly, and in a complete range not only of origins but of merit. American architects have adapted historic styles as badly and as well as it is imaginably possible for adaptation to go,—but if we are to suppose this era to be nearing its close, have we not so come of age æsthetically that we can demand only the very finest work? It has always seemed to me a futile business to work in a borrowed style without interpreting it at least as well as those who originated it. Our task is not, inherently, so difficult. We have the best things they did to serve us as models and standards.

It would not be wise to say that any one style of the historic periods is more easy or more difficult to adapt, today, than any other. Or that the flair of any architect for adapting one style surpasses, necessarily his flair for adapting another. This concerns itself more vitally with good taste, which is not to be had from books. It is true that many architects have become known, and justly, for their achievements in one historic style. As thoroughgoing an architect as John Russell Pope does a Georgian Adam house as finely as the Hitt house in Washington, a Tudor house as well as the Duncan house in Newport, and an eighteenth century French house as finely as the Laughlin house in Washington. But there are not many such architects; if there were, there would be more really distinguished houses designed in the historic styles.

Certainly our achitecture has reached the point where the period adaptation needs to be thoroughly done or let alone. We cannot, indefinitely, have much patience with pretentious houses, whether they are English, French or Italian, unless they show a high degree of good taste on the part of the architect. There have been plenty of French houses in this country, but not many which have been really fine. This house for Irwin Laughlin, from the office of John Russell

Belmont Place Facade

THE TERRACE GARDEN
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT



ENTRANCE HALL
"MERIDIAN HOUSE," RESIDENCE OF IRWIN LAUGHLIN, ESQ., WASHINGTON
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

Pope, is perhaps as fine a piece of work of its kind as this country can show. The French manner here has worn several period costumes,—especially in town houses. And there have been more chateaux in the way of country houses, or houses detached, than houses such as this by Mr. Pope. "Biltmore," in North Carolina, is still a fine thing of its kind, and two of the Vanderbilt houses in New York, Francis I in manner, will always be missed. It is a pity that Fifth Avenue was so in need of improvement that these had to be demolished. Most other French houses in New York were done in what was, at the time of their building, "modern" French architecture, that is, the profusely detailed and over-detailed manner that was being taught at the Beaux Arts. The recently demolished residence of the late Senator Clark was a not too unfair example.

More nearly in character with the house here illustrated are such houses as the Gambrill and Berwind houses in Newport, though even these have not the restraint of the Laughlin house. And such examples as the Stotesbury house outside Philadelphia have been effective mainly in their reënacting the Grand Manner. To re-create the really chaste phase of the Style Louis XVI is quite another matter, and one comparable in difficulty only with an authentic rendering of the style of the brothers Adam. Even to an eye architecturally untrained there must be, in the Laughlin house, a feeling of authority, of an inescapable finesse in its very corners,—so finely sharp in its every moulding, so incredibly restrained. A high wall partly masks its entrance, with a very stylized sphinx flanking the terrace balustrade at its abutment to the right of the shallow forecourt. Even in mass the house has a delicate nicety, to the slate mansard behind its balustraded parapet. The chimneys are as finely proportioned as a French mantel clock, and every exterior moulding is so perfectly scaled to the whole building as to suggest the nicety of a piece of furniture of the period. It seems to be an exterior (and how rare they are!) free from architectural regrets. Here is an exemplar of good taste,—an achievement not only in architectural manner but manners so sure that even the possibility of a *faux pas* is not to be conceded; faultless architectural diction; an architectural *beau geste* even in a style of which the essence was the

South Facade

"Meridian House," Residence of Irwin Laughlin, Esq., Washington

Office of John Russell Pope, Architect

gesture that reflected a graceful scheme of life.

On the terrace elevation there are tall windows with tall shutters, a curved bay with composite columns, ironwork that can only be called, in spite of its material, charming. For some reason, perhaps because of half-forgotten memories of an autumnal Versailles, one thinks of this terrace as on a late October afternoon, with a few yellow leaves fallen in the gravel walks,—a warm, distant haze, and the curious sadness that there is in places very beautiful and perfect. The outer elevation of the terrace shows to the street only a high wall, with a rail partly solid and partly balustraded, and garage doors opening at the street level. It is a proper rear elevation for such a house,—dignified to the point of urbanity; exclusive as a chateau was exclusive when peasantry peered through its tall iron gates. Undemocratic? That was an architecture that did not even pretend to be democratic, and could not have been democratic even if it had considered the pretense worth making, and which it most assuredly did not.

The approach to the interior is a sweeping stair, up from a foyer. There is the scale of the Grand Manner in the array of tall columns, and there is an incredible perfection of scale in every moulding and in the gracefully cursive ironwork of railings and consoles. *Au premier etage* the foyer looks through three arched openings into a sitting room,—it might be called an *entre salle*,—exquisitely done, the walls in the architectural manner so essentially of Louis XVI, with Ionic pilasters, bas reliefs over the doors, and classic busts on console brackets. In this room there is the bow window which we have already seen from the terrace, and to enter, from the foyer, one passes between two sphinxes, a delightful fancy of the period, strictly classical as to their bodies, and with the high coiffed heads and coquettish realism of eighteenth century courtesans.

The ball room, as might well be supposed, is an affair of Corinthian pilasters and crystal chandeliers, of sectional mirrors and beautiful ironwork,—highly stylized, gracious, ultra-formal, with a formalism that is not cold. In the creation of this kind of a room the Style Louis XVI excelled,—and its re-creation here achieves the old illusions without being, even remotely, antiquarian. The dining room is, as might be expected, chaste to a degree. It is a room of finely

West Facade
"Meridian House," Residence of Irwin Laughlin, Esq., Washington
Office of John Russell Pope, Architect

planned plaster panels, its mantel very, very stylized, and its only other conspicuous feature a fine French tapestry. The whole manner of this house, deriving so definitely from the eighteenth century France of Louis XVI, is grand without being grandiose; impressive without being pompous; rich without being ornate. The library is more *intime*, and properly so. There would need to be, in this kind of a house, something to serve as a living room. Here the possessions of the people who live in the house become more important than the architecture. From the nature of things this would have to be so, and an intelligent architect is the first to recognize it. No matter how much a house is designed for a formal scheme of life, and for formal entertaining, there is much of life to be lived otherwise than in this manner, and of this account must be taken.

Certainly the manner of this house has not, in this country, been better done, not only in terms of stylistic authenticity but in terms of pure architecture, meaning good taste in selectivity, in elimination, in execution. It cannot, from its nature, do otherwise than set a standard which should endure permanently,—a standard which should be seriously considered whenever a prospective builder decides he must have this or that type of house from the historic pages of our great picture book of European precedent.

There is, in this distinguished house, more than mere stylization. There is an unusual degree of good taste with refinement of scale in mouldings and other profiles carried out with far more fidelity to the very essence of the style than is observable in most contemporary work of the period in France. There are, in fact, plenty of very poor examples of the style of Louis XVI in France, and few that could so well be presented as an exemplar if a student were to ask for a consistently fine example. The grandiose heaviness of Mansart and Oppenord, plus the fantasy of the Rococo, were not transformed either suddenly or completely into the chaste delicacy of Louis XVI.

W. H. Ward, a very thorough English authority on the whole evolution of eighteenth century French architecture, is valuable to quote if one would refresh one's memory of the circumstances that brought about the French classic revival that culminated in the ultra-classic styles of the Directoire and the Empire. "This period," writes Mr. Ward, "is marked architecturally by a reaction toward antiquity and simplicity; and though the reign of Louis XVI covers but a small portion of it, the style which resulted from this reaction has by common consent received his name. Its beginnings may be traced to the second quarter of the century when the Palladian Rococo compromise was generally accepted in France, and Baroque and Rococo held undivided sway in Germany, Belgium and Spain." New discoveries in Pompeii and Herculaneum stimulated a first hand appreciation of antiquity, and the didactic Palladian doctrines, together with the dictates of Vitruvius, began to lose their authority. "Antiquity began to appear in an entirely new light, and architectural thinkers realized that they had hitherto been accepting a mere fragment of the performance of Rome as fully representative of the whole architecture of the classical ages. They now saw that the departures from Vitruvius' canons already observed were not isolated aberrations,—that the ancient architects, and especially the Greeks, had been wholly unconscious of the existence of such canons. Instead of handing down to posterity the vivifying principle which had brought the whole glorious art of antiquity into being, Vitruvius was seen to have nothing to offer but a sort of pemmican, compounded out of a few specimens, and those not all of the first quality. . . . The whole edifice of rules and orders, proportions and modules, so laboriously built up by a long line of writers, stretching from far-away Albert to Briseaux in their midst, was seen to be raised on phantom foundations, and down it came about the ears of the architectural world like a house of cards. . . . These revelations, far from discouraging the study of antiquity, only convinced men that much more might be learned from ancient monuments than the academic school had supposed. More than this, it was the opinion of many thoughtful persons that the restoration of a simple and noble style could be attained only by such study. . . . Architects exhibited an increasing submission to the guidance of antiquity, with whose monuments there was now a wider and closer acquaintance. Yet the old academic methods, though shaken, on the whole maintained their sway, and the new ideas influenced detail and ornament more than composition. . . . The resultant style is characterized as regards the main architectural lines by a four-square sobriety; as regards decoration by refinement; and generally by classical purity."

This would fairly describe the Laughlin house, in which it seems as though the architect had taken the style of Louis XVI, with all its defects, and converted every defect into a perfectly stylized virtue. Outside a few superficial writings, and an unexamined tradition, this style seldom attained the classic perfection at which it aimed. For this reason, among others, Mr. Pope had no inconsiderable advantage over the architects of the time of Louis XVI. He could examine their works, get an idea of the thing they were trying to do,—and then do it better. Certainly there is nothing experimental in the technique of the Laughlin house inside or out, for here are fine forms rendered with the utmost finesse of manner.

BOOK DEPARTMENT

AMERICAN ARCHITECTURE OF THE TWENTIETH CENTURY

A REVIEW BY
DOUGLAS WILLIAMS

ALTHOUGH the outstanding examples of recent architecture have been made familiar through the pages of the architectural journals, members of the profession will be able to appreciate the value of a publication made up of large loose leaf plates showing illustrations and measured drawings of these great buildings in a compact and well organized manner. The collection of plates which is the subject of this review is one of the first important attempts on the part of an architectural publisher to cover the important subject of American architecture of the twentieth century in anything like a complete, compact and usable form. Certainly material of this sort should be greatly in demand by the architectural profession, since it presents clearly the form, proportions, and detail of the best examples of buildings which go to make up the outstanding achievement of twentieth century architecture and of the American people for all time.

The skyscraper form of building is a distinctly American type and is the product of a great industrial people. The so-called classical styles were undoubtedly beautiful and filled the needs of the people by whom they were developed, but in the present era of frenzied activity and intense concentration of business industry within limited areas, these classical types have been found to be quite inadequate, and it became necessary to develop an entirely new order of construction and new forms of building materials so that greater freedom might be had in building vertically to great heights. At first, attempts were made to support buildings on masonry walls, but when the structures exceeded six or seven stories in height the lower walls were of necessity so massive as to occupy the greater part of the lower floor space. The problem of verticality was solved by the use of steel or ferro-concrete framework supporting curtain walls of masonry.

Alabama Power Building, Birmingham
Warren, Knight & Davis, Architects

The height to which such structures may be carried now seems to be almost unlimited, and as we look at the Chanin Building and realize that on the opposite corner will be a still taller structure, we wonder where the thing will end. It early became apparent that the construction of so many enormous structures along the edges of comparatively narrow thoroughfares would result in the streets becoming dim and narrow canyons such as are found in the lower part of Manhattan today. In providing for the elimination of this condition, the city planners unwittingly invented a type of structure which in the hands of our best architects has resulted in the beautiful "set-back" style and has brought to the world an entirely new architectural type. Inspired by the greater possibilities latent in the new building materials, designers have developed a new form of design which, in its better manifestations, is characterized by a dignified simplicity and appropriateness to the spirit of modern times. New freedom in design naturally is not restricted to structures of the skyscraper type but has resulted in many beautiful edifices among other classes of buildings, such as churches and smaller buildings where the need for height was not so pressing as in other buildings.

As we continue to develop, it is difficult to foresee what the future may have in store, and it would be impossible at this time to predict anything in the nature of a final work on twentieth century architecture. It therefore seems very fitting that the publishers and editor of the present series of illustrations and drawings have chosen to issue it in the form of a progressive publication of separate volumes and parts, each of which may be purchased separately. In this way the development and trends of building design may be followed and a splendid collection of reference on the new architecture be built up as rapidly as further

Unless otherwise noted, books reviewed or advertised in THE FORUM will be supplied at published prices. A remittance must accompany each order. Books so ordered are not returnable.

GRADE SCHOOL BUILDINGS; BOOK II

IN no department of architecture have the last ten years seen quite the progress which has been made with schoolhouses, a class of buildings of the first importance, since they exert a strong influence upon their communities, and by their architectural excellence or the lack of excellence they elevate or lower the architectural standards of entire districts. Study of school structures, particularly at the hands of a group of well known architects, has resulted in their being given a high degree of architectural distinction and dignity in the way of design, while study directed toward their planning and equipment has led to their being practical and convenient far beyond what was regarded as an advanced standard of efficiency anywhere in America even a few years ago.

Kensington Schoolhouse, Great Neck, N. Y.
Wesley Sherwood Bessell, *Architect*

THIS volume, a companion to another published in 1914, records the results of endless study and experiment in different parts of the country, summed up and presented. By illustrations of exteriors and interiors, by floor plans and carefully written descriptions and articles by well known architects and educators, the present high standard of schoolhouse design is made plain, and these results which have been achieved by a few architects and school boards are thus made possible to all architects who are interested in schoolhouse design. The compiler has selected from almost 1000 exteriors and floor plans the school buildings to be illustrated, and the volume records "a process of innovation and elimination, namely, the introduction from time to time of features which have been deemed desirable and practical, and the elimination of things which, owing to changed school methods, are no longer required."

400 pages; 7¾ x 10½ inches
Profusely Illustrated; Price $10

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progress is made. The size of the plates, 14 by 20 inches, together with the fact that they are loose leaf, makes them extremely usable, and their collection into portfolios of 20 plates also adds to their utility. The work is carefully edited by Oliver Reagan, A.I.A., and the paper, printing and general make-up of the work resembles the well known monograph of the work of Mc Kim, Mead & White, published likewise by the Architectural Book Publishing Co., Inc. The choice of buildings to be shown is left to the readers, and subscribers are invited to write suggesting the names of buildings they would like to have shown. The publishers agree that when a sufficient number of such requests have been received for a given building, that structure will be presented in a forthcoming issue.

Six parts of this series have already been issued and include a notable selection of important American buildings including the Bowery Savings Bank, New York; Ford Engineering Laboratory, Dearborn, Mich.; U. S. Army Supply Base, Brooklyn; Indianapolis Public Library; Grauman's Metropolitan Theater, Los Angeles; Panhellenic House, New York; Irvine Auditorium, U. of P., Philadelphia; Los Angeles Mail Order House of Sears, Roebuck & Co.; and many other outstanding buildings of the same class representing the work of many of the foremost American architects of the day.

Of course no work on our modern architectural design would be complete without examples of the work of Bertram Grosvenor Goodhue, who played such an important part in the origination and development of the new type of design. A complete portfolio of 30 plates is devoted to some of the best specimens of his work, including the Nebraska State Capitol; the Church of St. Vincent Ferrer, New York; the National Academy of Science, Washington; and the Los Angeles Public Library. Of the buildings published thus far, from two to four plates of illustrations and from one to four plates of drawings are shown for each, the photography being done in the best architectural manner so as to show the proper proportions and as much detail as possible, and the choice of subjects is representative of all classes and types.

AMERICAN ARCHITECTURE OF THE 20TH CENTURY. A Series of Illustrations and Measured Drawings of Commercial and Industrial Buildings. Edited by Oliver Reagan, A. I. A. Complete in 4 Volumes or 12 Parts, each Part containing 20 plates, 14 x 20 ins. Price per Part in Portfolio, $8.50; Price per Bound Volume, $30. Architectural Book Publishing Co., Inc., 108 West 46th Street, New York.

THE AMERICAN SCHOOL AND UNIVERSITY, 1929-1930. 462 pp., 7 x 10 ins. Price $5. American School Publishing Corporation. 443 Fourth Avenue, New York.

IN no department of architecture has there been made more striking progress than in its application to schools. The entire subject of schools in fact, from first to last, seems to have been so well and thoroughly studied that there is little if anything which has not been examined and re-examined, analyzed and classified at the hands of educators, architects and the designers and manufacturers of school equipment. When a school is to be established today the scope of its activities is made the subject of an exhaustive and critical survey, first to determine the need of a school, and then to discover just what type of school it should be. With the results of

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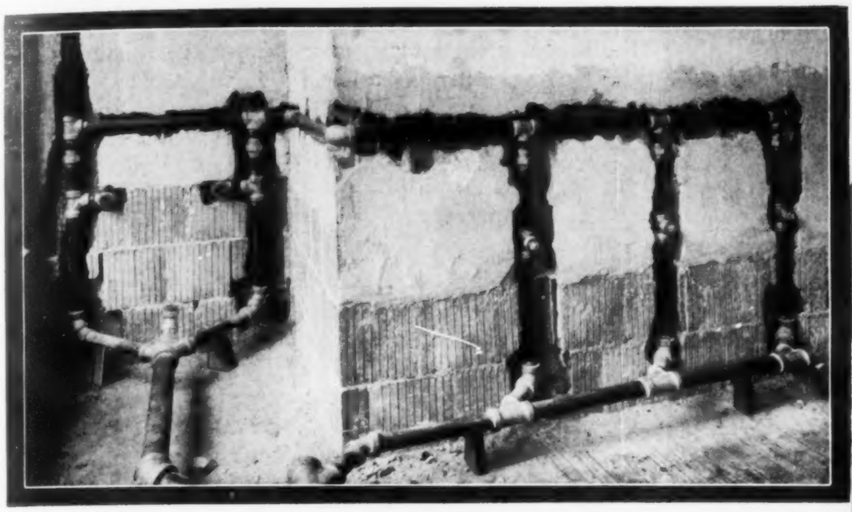

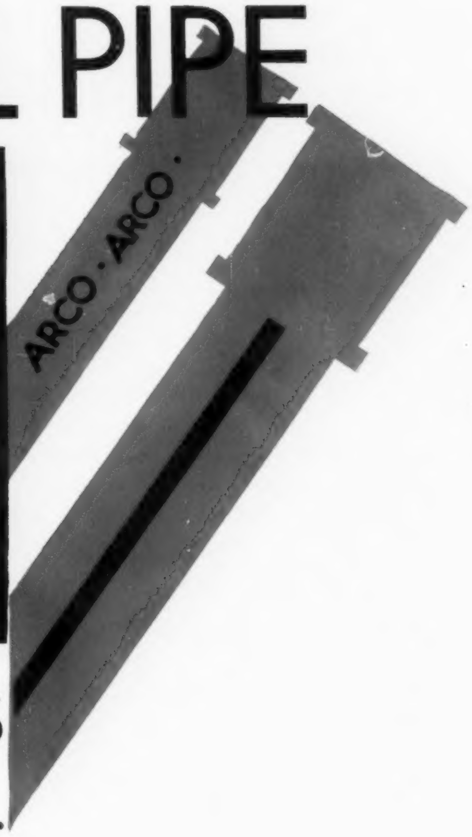

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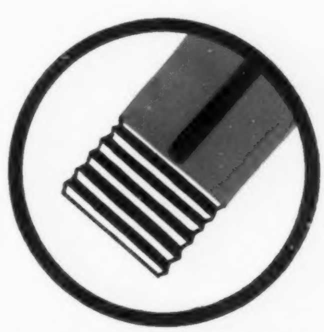

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By

CHARLES Z. KLAUDER *and* HERBERT C. WISE

Hensel Auditorium, Franklin and Marshall College
Charles Z. Klauder, Architect

A NEW and ever higher standard is being established for the architecture of educational structures of all kinds. Some of the most beautiful buildings in all America are those venerable halls in academic groves in Charlottesville, Cambridge, Princeton and elsewhere built by early American architects, and now after long decades of indifferent designing and careless planning American architects are rising anew to the situation and are designing educational buildings of every type which closely rival even the best work of a century ago, while in planning and equipment they establish a standard which is wholly new.

¶ In this valuable and important work two widely known architects of educational buildings collaborate in reviewing the entire situation as it applies to college and collegiate architecture. They have carefully studied practically every important institution in the country, and in their text they discuss administration buildings; dormitories; recitation halls; chapels and auditoriums; gymnasiums; libraries; and structures intended for certain definite and specific purposes, such as the teaching of music, all this being well illustrated with views of existing buildings and in many instances with floor plans and other drawings. A valuable and extremely practical work to add to the equipment of any architect's office.

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such a survey as a foundation, there comes consideration of a site with reference to its accessibility, its being near the center of the district to be served, the character of its surroundings, the nature of its soil, etc., and all this before there comes more than slight consideration of its architecture. With extensive data thus at his command, the school architect approaches its actual planning and designing, aided constantly by highly trained and experienced educators and by the designers and makers of every possible detail of school equipment, the school when finally completed and turned over to the school board and teachers being probably the last word in completeness and in architectural and mechanical excellence and well fitted to perform the work for which it was built. All this now forms the subject matter of many publications,—weekly, monthly or annual,—and recently there have been published a number of excellent works dealing with different aspects of the school problem.

This volume is the second annual edition of "a year book devoted to the design, construction, equipment, utilization and maintenance of educational buildings and grounds," and among the names of the many contributors who have collaborated in the preparation of the work one notes those of leaders in all the fields which are concerned,—widely known educators, architects, landscape architects and others. The completeness of the work and the thoroughness with which it deals with the subject might be indicated by an enumeration of its chapter headings: I, Selecting the Site and Planning the Budget. II, Design and Construction of Buildings. III, Modernization, Maintenance and Insurance. IV, Landscaping and Upkeep of School Grounds. V, Buildings and Equipment for Physical Education and Play. VI, Classroom, Office, Library and Auditorium. VII, Home Economics,—Cafeteria,—Laundry. VIII, Laboratory and Shop. IX, Chemical Index. X, Distributors of Equipment. XI, Architects for Educational Buildings. XII, School Superintendents in Cities of 10,000 and over. XIII, State Departments of Public Instruction. XIV, Alphabetical and Classified Lists of Manufacturers. School boards today depend upon their architects for far more than mere architectural service. The architect is expected to be fully informed regarding a host of subjects not even remotely concerned with architecture, and often in proportion to his knowledge and resourcefulness is the value of his service gauged. The excellence of this work entitles it to circulation among architects interested in any type of school architecture.

OLD WORLD MASTERS IN NEW WORLD COLLECTIONS. By Esther Singleton. 441 pp., 7½ x 11 ins. Price $10. The Macmillan Company, 60 Fifth Avenue, New York.

EVEN before the beginning of the World War period, vast changes were taking place in the world. Countries which for ages had been leaders in commerce, in industry, in art, and in every other form of activity found their power gradually waning as the Republic of the West increased in strength and power and moved ever more and more toward the center of the world's stage. The Great War, which left the greater part of Europe impoverished if not actually ruined, meant the unconditional surrender of the Old World to the New, and gain to America in possibly more ways than one in

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perhaps a ratio out of all proportion to Europe's loss. In every age conquerors have taken toll of the art treasures which circumstances have placed at their disposal. The practical Romans laid heavy hands upon the riches of cultured Greece; persecuted Christianity emerged triumphant from the catacombs to plunder the temples of pagan antiquity for material of which to build the Christian fanes which presently arose; St. Mark's, that treasure house of splendor, meant much pilfering from the East; Napoleon dealt with ruthless hands with many of Europe's museums, and in fact many a museum has been enriched at the cost of those in other countries, the balance having been sometimes restored when later wars and other victories made restoration necessary. Long before the Great War the world's art treasures began coming to America's shores,—the result not of victory in battle, unless economic and commercial rivalry be so considered, but due to America's lavish and constantly increasing wealth. Paintings, marbles, tapestries, statuary and other works of art which for centuries had been among the ancestral possessions of great families were suddenly found to be in American museums or private collections. Even some cathedrals and ancient monastic foundations found themselves unable to resist the lure of gold offered them by the resourceful art dealers who constitute the link connecting owners old with owners new, and today one has ceased to express surprise at hearing that some priceless treasure has passed from the possession of an Italian prince or an English duke into that of some American manufacturer or banker. The transfer of ownership, it might be observed, is much more than likely to be eventually to the advantage of the world, taking the world as a whole. Americans as a rule bequeath their collections to public museums where they enrich the facilities for public culture, while in Europe the same treasures served merely to give pleasure to their owners and their owners' friends.

In this volume an author widely known as holding accurate and conservative views on art has made a survey of the paintings by the great masters of Europe which at present are in American private collections. The work deals with rather more than 100 paintings, and to facilitate the preparation of the volume she has had the enthusiastic coöperation of the collections' owners. The work, be it understood, deals with portraits, mythological and *genre* subjects and with some subjects which are religious, but leaving out subjects which portray suffering; here there are no pietas, crucifixions, or paintings of saints undergoing martyrdom. Under the general heading of Italian painting the author considers work of various schools,—Siena, Florentine, Umbrian, north Italian, and Venetian, and then in their turn she deals with painting of the Flemish, Dutch, German and Spanish masters and with the work of France and England during the eighteenth century. The author, as has been already suggested, approaches dealing with a subject so important with extensive background. She is already widely known for her writings on various departments of art, and the volume's illustrations as well as its text have been prepared with all the thought and care which one would look for in a work from her study.

"Hotel Planning and Outfitting"

EDITED BY

C. STANLEY TAYLOR and VINCENT R. BLISS

Here is a volume which for the first time adequately reviews the entire subject of the modern hotel,—its planning, designing, equipping, decorating and furnishing. It covers every detail, from the beginning of sketch plans to the registration of guests when the house has been completed and opened. All the different types of hotels are dealt with,—the Modern Commercial Hotel, the Residential or Apartment Hotel, the Resort Hotel, and the Bachelor Hotel. The volume is replete with views of hotels in different parts of the country; their exteriors and interiors, and in many instances their plans are included and fully analyzed.

The editors have been assisted in the preparation of the work by widely known hotel architects and interior decorators and by actual operators of hotels,—practical men, experienced in the management of the "back" as well as the "front" of a hotel. The volume's treatment of hotel furnishing and equipping constitutes the final word on this important subject. There are included views of hotel restaurants, cafeterias, kitchens, pantries, "serving pantries," refrigerating plants and all the departments which are necessary in a modern hotel of any type. The work is of inestimable value to architects and engineers, as well as to practical hotel men.

438 pages, 8½ x 11¼ inches—Price $10

THE ARCHITECTURAL FORUM

521 Fifth Avenue, New York

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From an Oil Painting by Percival Goodman

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"Block House," Stanwich, Conn. *Frontispiece*
From an Oil Sketch by Frank A. Wallis

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PART TWO—ARCHITECTURAL ENGINEERING AND BUSINESS

View of the Fuller Building, New York *Frontispiece*
From a Photograph by George H. Van Anda

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PARKER MORSE HOOPER, A.I.A., Editor
KENNETH K. STOWELL, A.I.A., Associate Editor
Contributing Editors:
Harvey Wiley Corbett; Aymar Embury II; Charles G. Loring; Rexford Newcomb; C. Stanley Taylor; Alexander B. Trowbridge
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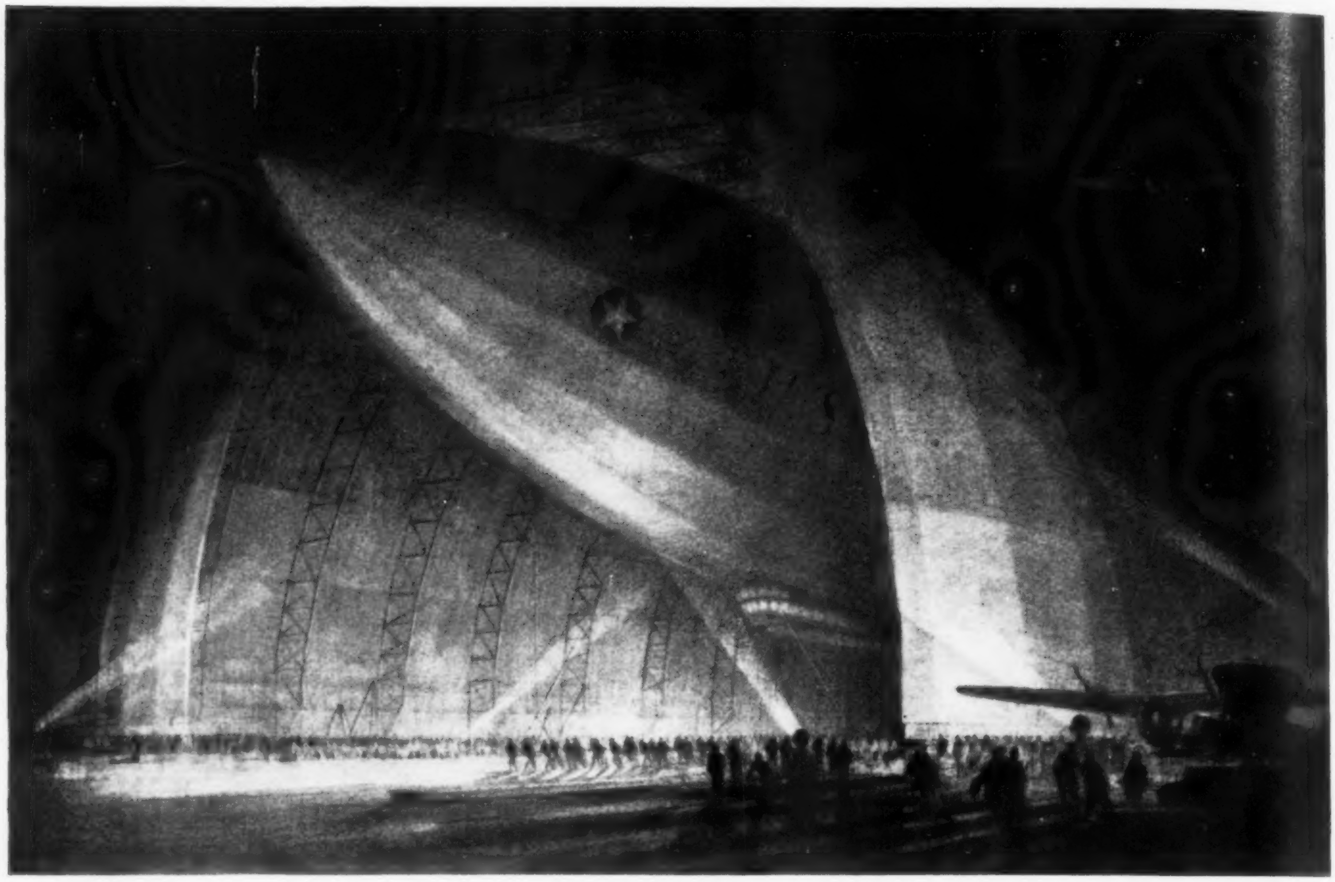
STRUCTURAL STEEL CREATED THE SKYSCRAPER

A reproduction of this rendering by Hugh Ferriss, suitable for framing, will be mailed free of cost to any architect



In the modern spirit

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STEEL INSURES STRENGTH AND SECURITY

Vertical Perspective

VIEW OF THE FULLER BUILDING, NEW YORK

WALKER & GILLETTE, ARCHITECTS

Photo. George H. Van Anda

UNIV. OF MICH.

THE
ARCHITECTURAL
FORUM

VOLUME LI . NUMBER TWO

AUGUST 1929

THE CONSTRUCTION AND EQUIPMENT OF THE FIDELITY-PHILADELPHIA TRUST BUILDING

SIMON & SIMON
ARCHITECTS AND ENGINEERS

IN the construction of the Fidelity-Philadelphia Trust Building, Philadelphia's largest office structure, within 16 months from the time wreckers went on the site until the completed structure was turned over to the new tenants, emphasis was placed on the time element, important in large building enterprises. In Part One of this issue of THE FORUM there is a description of the architectural features of this building. In this article it is proposed to extend this description to cover the constructional, structural, mechanical and electrical features of the building.

Demolition. On January 24, 1927, a contract was awarded to Irwin & Leighton of Philadelphia. On March 1, 1927, work began on the demolition of the existing buildings. This work was an important factor in the limit of time allowed for the completion of the structure and affected the entire building program. One of the old buildings was a large theater, the foundations of which were of rubble, mass concrete and brick. The structural frame of this building was of steel, and the floors, balconies, proscenium arch, box fronts, lobbies, etc., were of reinforced concrete with slabs from 8 to 12 inches thick. In fact, this applies also to the reinforced concrete in the theater building, all of which was extraordinarily heavy in keeping with the building practice of the day when concrete construction had not been sufficiently developed to permit the use of light slabs and modern reinforcement. Because the use of dynamite might have inconvenienced neighbors or have endangered wheel and pedestrian traffic, skull crackers were employed to reduce these large masses of concrete to fragments which could be conveniently removed.

Foundations. An elaborate system of core borings was made, and the location of the ledge rock was definitely determined prior to the preparation of the foundation design. Calculations were made of a number of kinds of foundations, and the final decision was for the open caisson type which accomplished the required purpose in the least time and with the minimum expenditure. The large tonnage of the column loads required that the foundations be carried to the solid rock, and accordingly a foundation was build for each column. There are 138 caisson foundations varying in size from 3 feet, 8 inches square to 8 feet, 4 inches square at the top. The caissons are of concrete, cast in place, unreinforced except at the tops immediately below the points of application of the column loads. Considerable difficulty was experienced in sinking these caissons, as the level of the ground water is approximately 45 feet below the curb. Owing to the density of the soil overlying the rock, it was found after experiment that the only way to expeditiously construct these foundations was by pumping the ground water from each caisson pit. The same type of foundations, although entirely apart from those of the building, was used for the safe deposit vault which measures approximately 38 feet wide, 91 feet deep, and is two stories in height. There was nothing extraordinary about the character of the foundations, except that record speed was made in building them, considering the fact that it was necessary to begin work on many before the demolition of the buildings overhead had been begun.

Underpinning. It was necessary to underpin the westerly wall of the Witherspoon Building, adjoining the Fidelity-Philadelphia Trust Building on the east. The Witherspoon Building is 15 stories in height; several of these stories are unusually high due to there being an auditorium, thus making extraordinarily heavy concentrated loads. Several different methods of underpin-

View of Steel Construction Showing the Girder Over the Banking Space

ning were considered, but that which would cost the least money and which could moreover be the most rapidly performed was the erection in individual sections of a concrete wall of adequate thickness supporting the foundations of this building to the depth of the lowest excavation of the Fidelity-Philadelphia Trust Building. This wall was supported on concrete-filled steel-shell piles 16 inches in diameter, the steel shells being 3/8 inch in thickness and designed to carry the entire load to bed rock. Each individual pile supported not more than 60 tons and was tested to 90 tons without producing settlement. The Fidelity-Philadelphia Trust Building stands on gneiss rock at a depth of about 60 feet below curb.

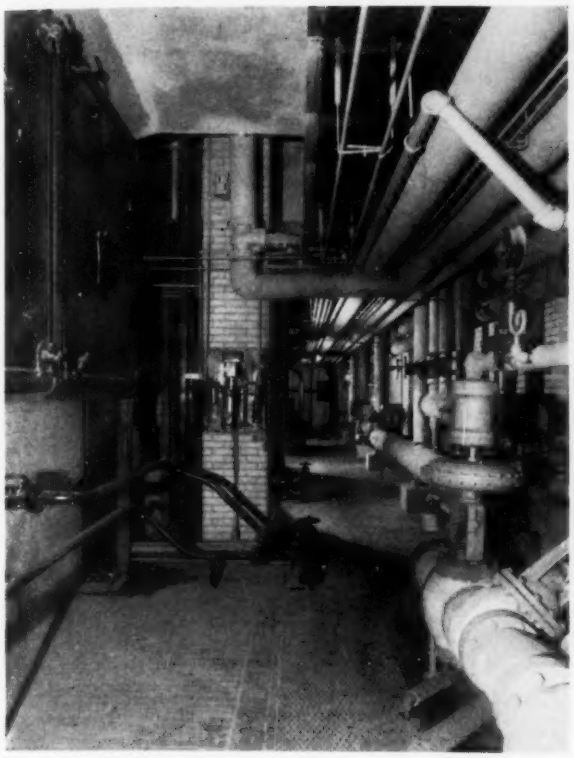
Less than two months after the contractors began work, the first caisson was sunk. Four months later, in the presence of officials of the Fidelity-Philadelphia Trust Company and their guests, the cornerstone was laid. Progress was rapid, and seven weeks later the topmost structural steel member was swung into position. More than 14,200 tons of steel and 350,000 rivets were used in framing the structure. Six large girders span the top of the banking room and carry the center portion of the building. These are 60 feet long, 9 feet, 6 inches deep, and weigh approximately 58 tons each. They are among the largest girders in any office building in the city. The movement of materials was so planned that encroachment upon traffic was exceedingly small.

Steel Design. Let us consider the problem presented by the steel skeleton of the building. The heaviest dead loads for floors are those on the first floor. Those assumed for beams for this floor in pounds per square foot are:—

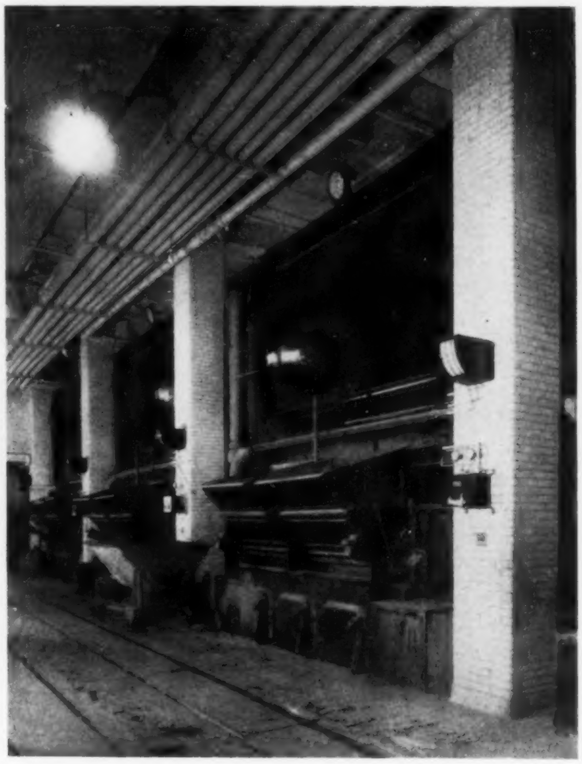
Marble	15
Cement	12
3-inch fill	20
4-inch stone concrete slab	48
Ceiling (of first basement)	15
Partitions	35
Fireproofing	22
Steel	10
Total	177

For girders into which these beams frame, an additional dead load of 7 pounds steel and 15 pounds fireproofing or a total of 199 pounds is assumed. Another heavy floor is that of the first basement with a dead load of 145 pounds for beams and 165 pounds for girders. For the typical office floor the dead loads for beams are:—

Cement finish	12
3-inch fill	20
4-inch cinder concrete slab	38
Ceiling or plaster	7
Partitions	15
Fireproofing	15
Steel	6
Total	113



Rear of Boiler Room, High-pressure Steam Header



View of Boilers Showing Semi-automatic Stokers

For the girders into which these floor beams frame, an additional dead load of 4 pounds steel and 8 pounds fireproofing, or 125 pounds, is assumed. The roof loads vary according to type of material used and the location of the steel member. Over the 29th and 29th mezzanine, the dead loads are, for purlins:—

Slag	6
Cement	5
4-inch cinder concrete slab	38
Fill (average 6-inch)	33
Fireproofing	12
Future ceiling	16
Steel	7
Total	117

An average of 9 pounds was added for the girders and trusses. The roof over the board room is assumed as weighing:—

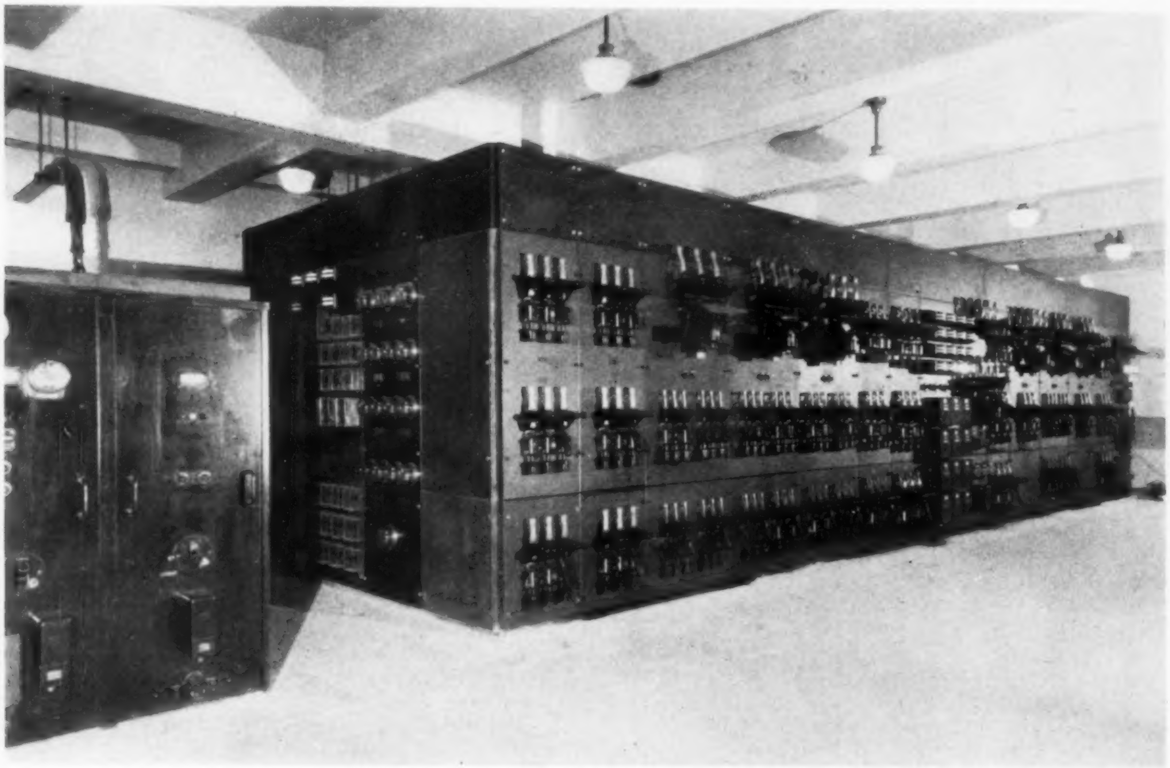
Copper	6
4-inch cinder concrete slab	38
Ceiling	20
Fireproofing	12
Steel	9
Total	89

In assuming dead loads for columns, the weight of the column, fireproofing with plaster around the shaft and reactions of the weights of heavy girders are all included. The dead load of a typical wall section is assumed at these weights in pounds per superficial foot:—

Limestone 6 inches thick	80
8-inch hollow brick	60
Plaster	5
	145
Deduction of 20 per cent for windows	29
Total	116

In each wall panel, 11 feet, 6 inches by 17 feet, 4 inches, are two windows, 4 feet, 4 inches wide by 7 feet high, permitting an allowance of about 30 per cent reduction in weight; the calculated reduction of 20 per cent is conservative. Heavier loads are assumed for walls below the fifth floor.

Other figures may throw an interesting sidelight on some of the phases of construction. At the labor peak there were 1,300 men employed on the site. Bricks of all kinds to the number of 4,180,000 were used. The cubic footage of limestone required was 100,000; 342,000 yards of plastering were done; 960,000 square feet of hollow tile partitions and 160,000 square feet of gypsum partition were erected; 116,000 square feet of Tennessee marble floor and wainscot were laid. By the terms of the original contract, September 1, 1928 was stipulated as the completion date, allowing 18 months' time. Marked coöperation between the subcontractors, contractors, architects, and the building committee made it possible for the time for construction to be shortened. In September, 1927, the date of comple-



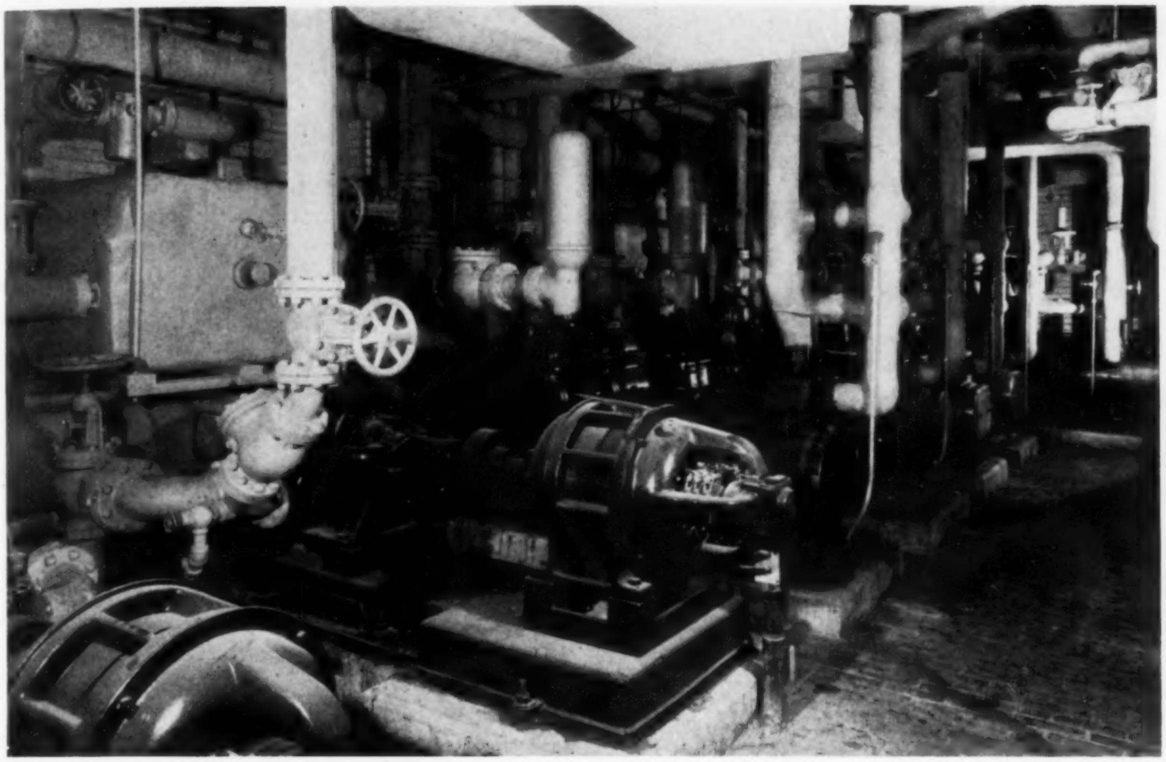
View of Main Switchboard Showing Trunk Panels and Low Tension Switchboard

tion was stipulated as June 1, 1928, three months earlier than required in the original contract. On March 1, 1928, 12 months after work had been begun, the Baltimore & Ohio Railroad occupied its space at the corner of Broad and Walnut Streets, and on June 1, 1928, in accordance with the new schedule, the office building portion was opened for occupancy, with but 15 months elapsed working time.

Elevators. The passenger elevators are arranged in two banks of ten each. One section of ten cars cares for the local passenger traffic and operates from the first to the 17th floor, at a speed of 700 feet per minute. These are of the gearless traction type with signal control and automatic floor-finding devices. The other section of ten cars serves express passenger traffic, with 800 feet per minute elevators of similar type and control to those of the other system. Two of these express shafts have openings to every floor throughout the building, and eight of them are enclosed shafts from the second to the 16th floor inclusive. In the banking house there are installed for operation between the second basement and the fifth floor, six elevators operated at a speed of 450 feet per minute. Two service elevators with a speed of 600 feet per minute open from the lowest or third basement to the 29th floor inclusive, and are used for freight and general building service.

The power plant in the lowest basement has five water tube boilers, semi-automatically stoked and built for a safe working pressure of 160 pounds per square inch. Three of these develop a horse power of 413½ each, and two 185 each, giving a combined normal horse power total of 1,610. From this plant are furnished the heat of the building, high pressure steam for pumps, and medium pressure steam for the kitchens. Three 6,000-gallon capacity oil tanks have been installed to be ready should the necessity for using this fuel ever arise.

The heating system is of the two-pipe vacuum return type with steam feeder main in the pipe loft of the 23rd floor. The office and bank portions have separate feeder mains, and the banking room is provided with a system of temperature control with automatic thermostat arrangement. Automatic control has been installed in the offices to shut off heat from radiators only. An elaborate system of ventilation assures an adequate supply of fresh air for all units of the building. The entire banking area has both supply and exhaust ventilation. In the main banking room four complete changes of air are accomplished every hour. This air is introduced to the system at the sixth floor level above the point where street dust contaminates, where it is filtered and then distributed. An independent supply of air is provided for the bank vaults.



Boiler Room Mezzanine Showing Steam- and Motor-driven Pump and Condensate Meter

Electrical System. The entire electrical requirements of the building can be carried on either of two 13,200-volt feeders, which enter the building from the Philadelphia Electric Company's service. In case one feeder should fail, a bus tie oil circuit breaker is automatically closed, which energizes the entire main truck board from one feeder, since the main high tension truck switchboard is arranged in two sections, one 13,200-volt feeder going to each section. When the feeder that fails is again placed in service, the incoming line oil switch on that feeder is automatically closed, and the bus tie switch is automatically opened, thus restoring the normal service. In case of trouble on a regulator, it is automatically shunted out of the circuit. There are two feeder regulators, each of sufficient capacity to carry the entire load, controlled by a six-board high voltage truck switchboard.

A bank of 13,200-volt primary to 230 volts secondary is of sufficient capacity to furnish all of the power requirements, excepting the elevators. A similar bank of transformers, except 115 volts secondary, furnishes the lighting requirements. A third bank of high voltage transformers, with 2,300 volts secondary, furnishes the electric elevators with power, and in an emergency will operate the fire pump. Although these nine transformers will meet the total requirements, there is installed a duplicate bank of nine other transformers, which will be automatically thrown in circuit should trouble be encountered in any other bank of transformers, so that continuity of service is assured.

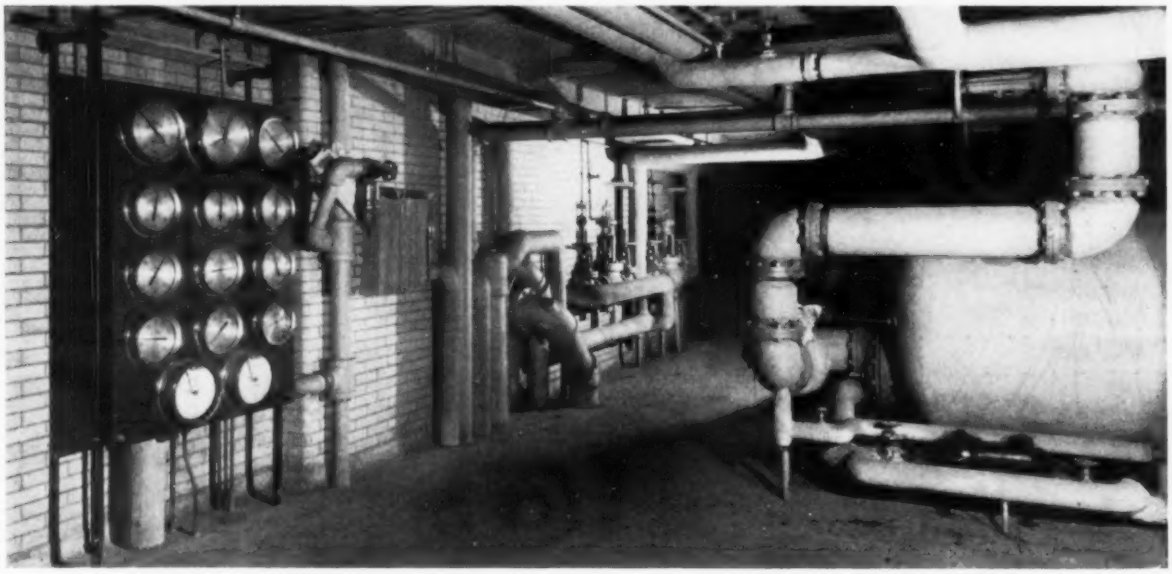
The power for the elevators at 2,300 volts is fed through steel armored cable to the elevator substations located on the 18th and 28th floors. In each of these elevator substations there is located a four-panel truck type switchboard, together with transformer equipment. Two sets of transformers are used, each of sufficient capacity, so that it might, if required, meet the total demand. The switching is so arranged that one bank of transformers is normally in operation. If the load goes above a predetermined value, the other bank of transformers is automatically cut in in parallel to take care of this excess demand. As soon as the load decreases, this second bank is automatically cut out. Should trouble develop in one bank of transformers, that bank will automatically be switched out of service, and the other bank will take care of the load. By interchanging the truck panels in the elevator substations, approximately the same amount of power can be taken from each bank of transformers during certain periods of time. Also located in the elevator substations, but in separate rooms, are four-panel low tension switchboards, containing metering equipment, feeder lines, etc., for each bank of elevators.

Portion of Kitchen for Bank Employes' Dining Room

A 15-panel low tension switchboard in the basement distributes all of the power and lighting requirements. By means of connections on this board, the entire lighting load of the building may be instantly changed to secure its current from either of the duplicate banks of lighting transformers, or in case both of these have failed, an auto transformer may be immediately switched into service, which will then supply the lighting from either of the duplicate banks of power transformers. By means of this same switching equipment and auto transformers, should both of the banks of power transformers fail, such power as must be maintained may be secured from either of the lighting transformers. In addition, a large storage battery has been installed, which furnishes emergency exit lighting and power for the automatic operation of switching equipment. On the same floor, but located in a different room, are four battery charging motor generator sets and control equipment.

Two static condenser equipments are installed in the same room with the elevator transformers, located in the elevator transformer station. The purpose of these is to improve the power factor of the load imposed by the elevator equipment. Between 60 and 70 motors and controls are installed throughout the building for operating ventilating fans and circulating pumps. Lighting and power distribution cabinets of the most up-to-date type are placed throughout the building. There are installed in this building approximately 740,000 feet, or 140 miles, of No. 12 and No. 14 code wire. On each wing of each floor is located a meter bar cabinet type panel of unique design. The design of these panels is such that it is a simple matter to readily arrange for the metering of the electric service furnished to one or more offices through a single meter.

Bank Vaults. The vaults of the bank are in the first and second basements. These two vaults are each 86 feet long and 33 feet, 4 inches wide. The safe deposit vault in the first basement is entered from an ample public lobby accessible

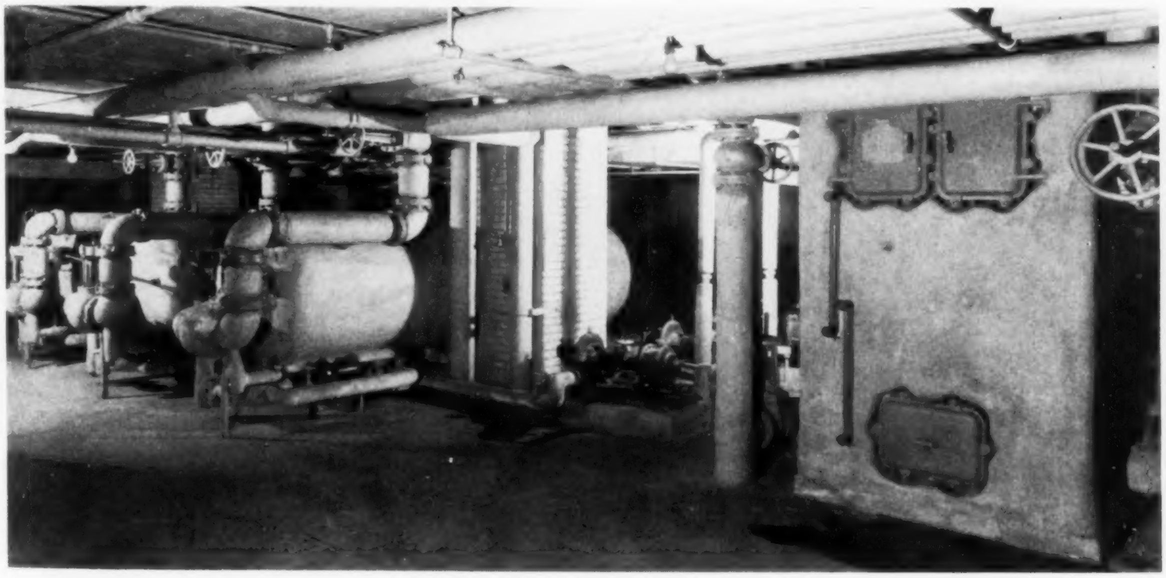


Boiler Room Mezzanine Showing Steam and Water Gauge Board, Recording Gauges and Water Pressure Reducing Valves

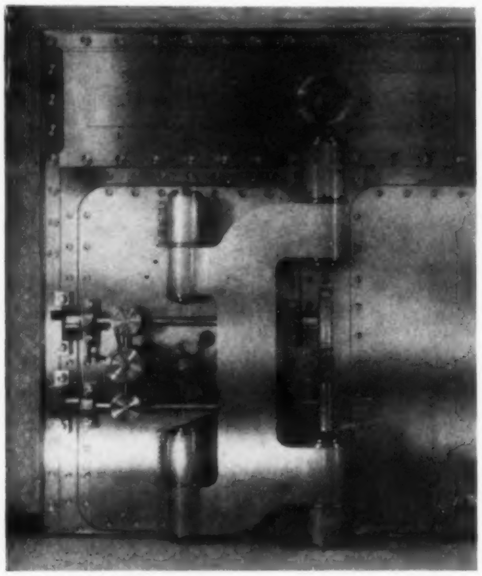
Another View Showing Kitchen for Bank Employes' Dining Room

View of Kitchen with Steam Kettle in Foreground

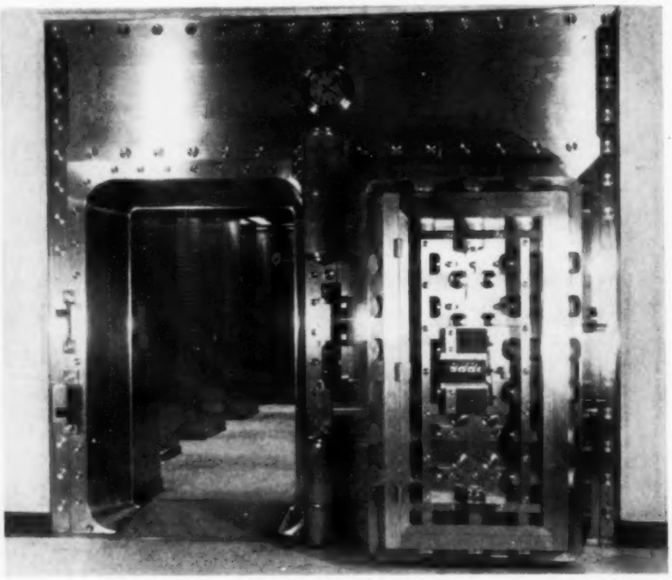
from the first floor by stairways and elevators. The vault is 12 feet, 5 inches high. Lacking only a few feet, eight full sized Philadelphia Rapid Transit trolley cars could be stored in the space occupied by the upper vault. These vaults are in reality separate structures within the building. No beams, girders or columns of the main structure pass through the vaults' walls or ceilings. Their walls and roofs are 24 inches thick. More than 200 tons of high grade steel make up the lining and equipment. Nearly 40 tons of special formula stainless steel renders the handling of the safe deposit boxes a cleanly process. The grease which has been the usual safeguard against rust is eliminated, and untarnished surfaces are maintained without inconvenience to patrons. Two electrical systems protect the vaults, while a sound accumulating system provides a third mode of safeguarding against attack. The individual booths of the safe deposit department



Hot Water Storage Heaters in Background. Boiler Feed Water Heater in Foreground

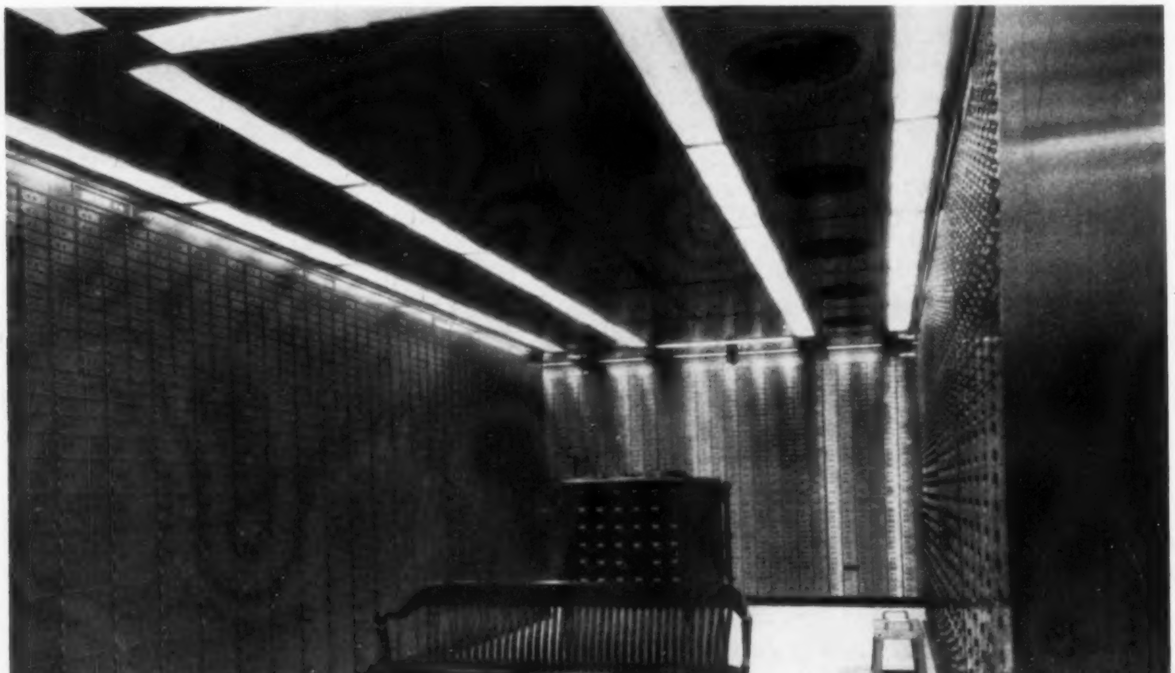


Safe Deposit Vault Door Closed



Safe Deposit Vault Door in Open Position

are so equipped that a record of each booth's tenancy and an inspection after every occupancy insure the safety of valuable papers overlooked by patrons. The vault for the bank's own cash and securities is on the second basement level. In this vault are held also those securities entrusted to the safekeeping of the bank and those in the custody of the corporate trust department.



Safe Deposit Vault. Note Special Lighting and Ventilating

CONSTRUCTION AND EQUIPMENT OF THE ATLANTIC CITY CONVENTION HALL

BY

SAMUEL L. WARE AND D. D. EAMES

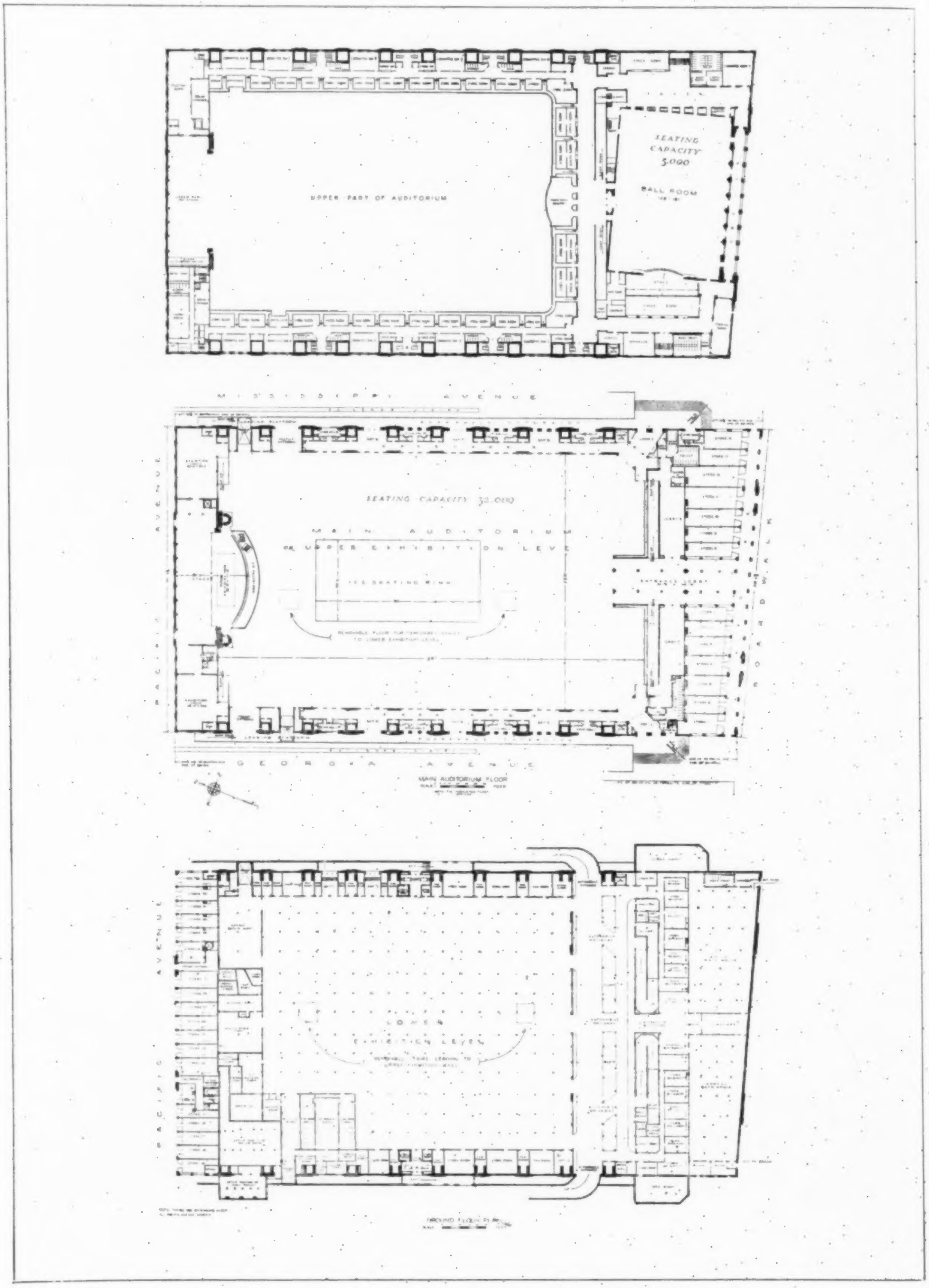
Editor's Note. The portion of this article which deals with construction is taken from the paper by Samuel L. Ware, who was formerly in charge of engineering in the architectural department of Lockwood, Greene & Co., Boston, presented before the Designers' Section, Boston Society of Civil Engineers. The portions of the article treating of the heating and ventilating systems, boiler plant, fire protection, etc., were written by D. D. Eames, engineer with Lockwood Greene Engineers, Inc.

IN order to maintain her prestige as one of the foremost convention cities of the country, Atlantic City is building the largest auditorium in the world. This municipal project will have cost when finished about $10,000,000 and will accommodate 40,000 people. The building occupies a block fronting on the Boardwalk. It is located midway between the two principal groups of the largest and newest hotels. The structure is 350 feet wide and has an average depth of 662½ feet, occupying the entire block.

Design and Construction. The main auditorium floor is 350 feet wide and 450 feet long. It has balconies on three sides and a stage on the fourth. These balconies project 38 feet into the auditorium, and are so planned that there will be 15 feet clear height underneath them, thereby affording ample space for exhibition over the entire auditorium floor. In addition to the main auditorium there is a large hall, 130 by 185 feet, on the second floor in the headhouse of the building. This hall can be used for smaller conventions, art exhibitions, banquets and dancing. It has a seating capacity of 5,000, and includes a stage, a large balcony, and a small musicians' balcony. There are committee and retiring rooms at each end of this hall. On the Boardwalk side of this hall there are full height bronze doors and windows opening out to a loggia 12 feet in width overlooking the ocean. The outer side of the loggia consists of a series of arched openings.

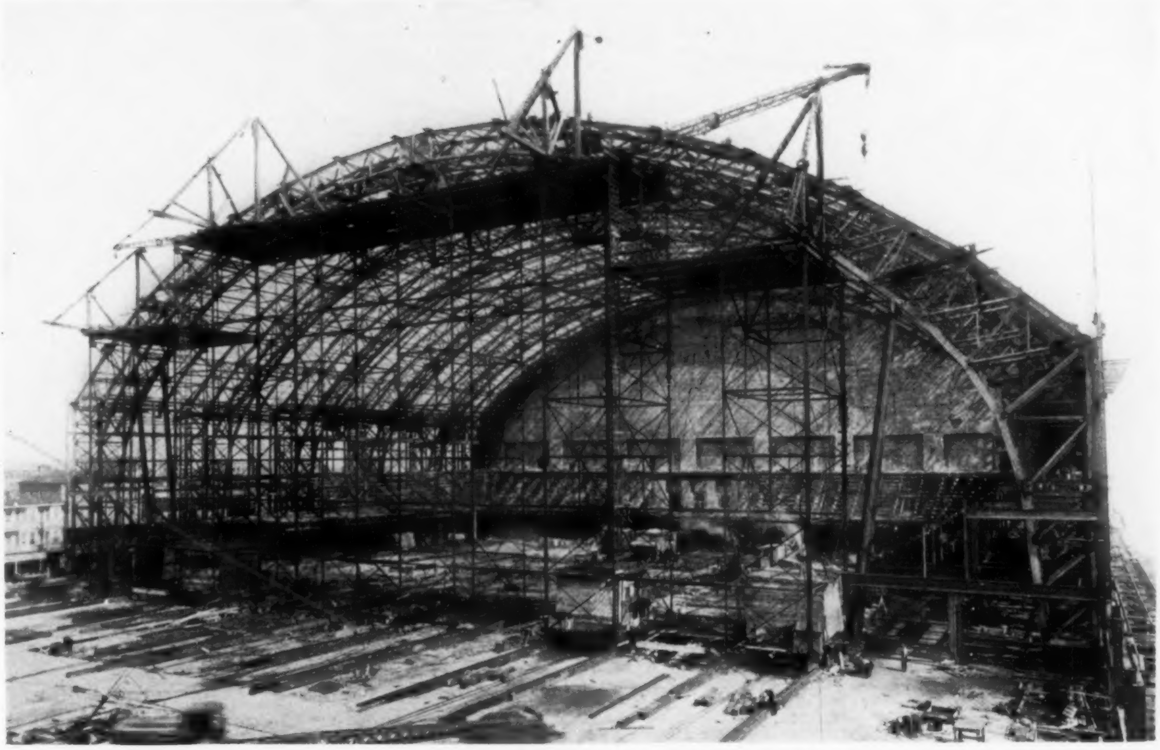
On the Boardwalk level an arcade has been arranged across the front of the building. Along this arcade are located 14 shops faced with marble and trimmed with ornamental bronze. In the center is a large ornamental entrance, 50 feet in width, leading to the main auditorium. This entrance lobby has walls of limestone with a vaulted ceiling of Guastavino tile. Corridors lead from it and connect with ramps leading to the lower and upper levels of the balcony of the auditorium. There is a basement under the entire area. At the front of the building there are bathhouses with entrances under the Boardwalk leading directly to the beach. Space has been provided on the ground floor to accommodate 400 automobiles. One-way traffic is provided for by means of a ramp entrance on Georgia Avenue leading from the street down to the ground floor,

Boardwalk Front of the Atlantic City Convention Hall
Lockwood Greene Engineers, Inc., Architects; Cook & Blount, Associated Architects



DIAGRAMMATIC FLOOR PLANS OF THE ATLANTIC CITY CONVENTION HALL

Lockwood Greene Engineers, Inc., Architects; Cook & Blount, Associated Architects



Erecting the Huge Trusses of the Main Auditorium

with a similar exit opposite, on Mississippi Avenue. This will allow guests at conventions to arrive and depart without confusion of traffic. Platforms ramping up from the Boardwalk grade extend the full length of the two sides of the building, and serve as exit areas to the auditorium.

The exterior walls of the headhouse are of Indiana limestone backed up with 8 inches of solid brick and 4 inches of hollow brick supported on a steel frame. The remaining portion of the building is faced with a buff brick. The exterior design is a modern adaptation of the Romanesque, incorporating therein the spirit of Atlantic City. The building is of first class construction throughout, short span concrete slabs with steel frame. The basement floor is built at the level of the ground water, grade +2.0. The grade of the ocean adjacent to this site is zero for mean low water and +3.5 for mean high water. The maximum grade of the ocean recorded in the most severe storms has been +10.0. The construction of the basement and the boiler room, which is 15 feet below the basement, was designed for a full hydrostatic pressure, with water at +5.0.

The character of the soil is a fine sand extending to an unknown depth. The foundation was built on 20,000 piles 30 feet long with a minimum butt of 12 inches. The capacity of the piles was taken as 15 tons. This capacity was not derived from any formula, since in this soil it is impossible to drive piles to resistance; 15 tons per pile was established by previous load tests. There have been many buildings built in this vicinity on spread footings, but it was considered advisable in this case that piles be used, as the beach at this particular locality is building up from year to year, and the level of the ground water is likely to change. In order to eliminate hazard of settlement by the lowering of the ground water grade from any cause, it was deemed wise to use piles. Piles were driven by water-jetting to within 2 feet of their final position. A day or more was allowed for the sand to settle around the piles, and then they were driven the last 2 feet by steam hammers. This eliminated the possibility of there being water or air pockets at the tips of the piles. In order to lower the ground water for the excavation of the basement and for pile driving work, a wellpoint system of piping was installed over the entire site. The natural grade of the site was +10.0. Two thousand feet of main 6-inch pipe were laid on the four sides of the site, with 20,000 feet of secondary lines of 3-inch pipe.

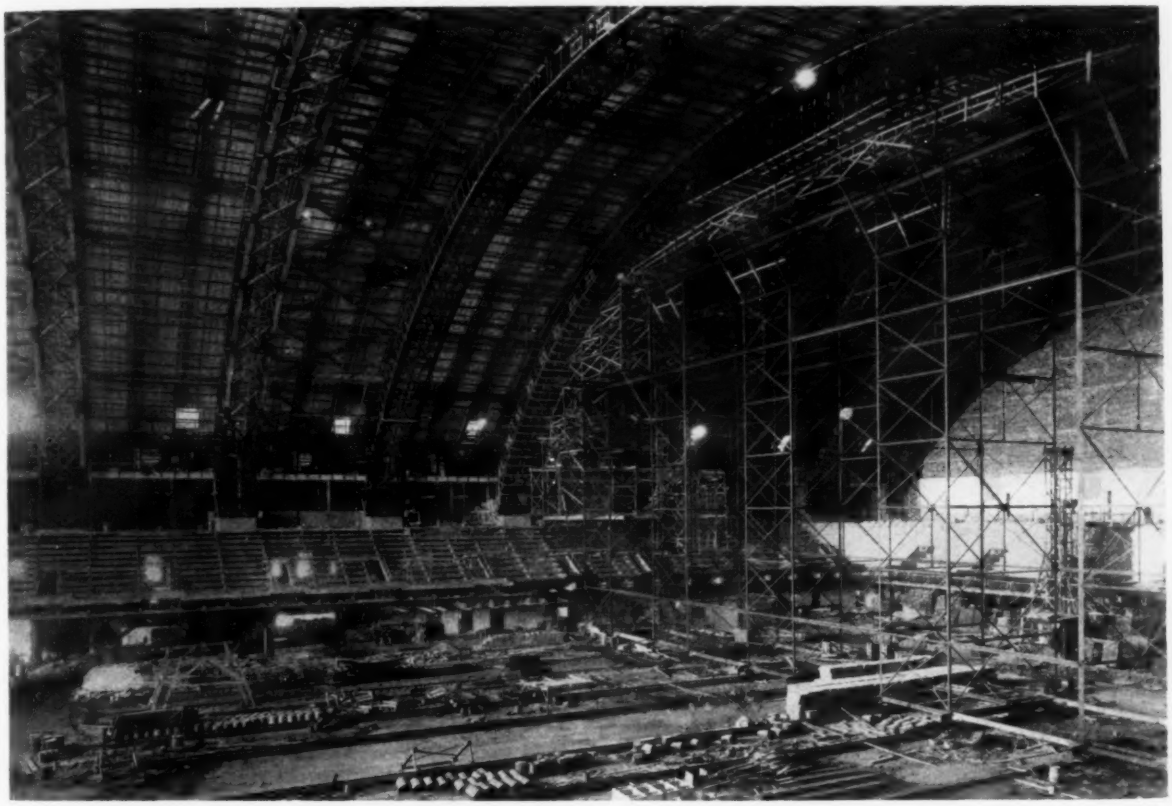
During the excavation of the boiler room, which is 25 feet below the street, two levels and in some cases three of wellpointing were necessary in order to efficiently operate the pumps. Piles were spaced 2 feet, 6 inches on centers. No trouble was experienced in accurately spacing the piles and driving them straight by the water-

jetting method in the type of soil encountered. The basement or ground floor was designed for a 125-pound live load and a hydrostatic pressure of 3 feet at the level of the floor. The construction consists of concrete beams and slabs. The beams were tied to the concrete mats of the pile foundations by hairpin dowels in order to help resist the hydrostatic pressure. Wood forms were used for the beams. The sand was properly graded between beams and acted as a form for the concrete slabs. Beams and slabs were poured in one operation. Hydrolithic waterproofing was applied over the entire basement. No expansion joints were used. Special care was employed at pouring joints to insure good bonding of concrete. The floor was heavily reinforced for temperature, and has thus far shown no visible cracks. The boiler room was one of the most difficult parts of design and construction in the entire project. The boiler room floor grade is —15.5, with a calculated hydrostatic head of 20 feet, 6 inches. The action of the fine sand saturated with water proved to be of such instability that the boiler room might as well have been built in the ocean, except for the use of the wellpoint system. When the water was lowered to a sufficient depth by use of the wellpoint system, the sand was easily handled and would stand without shoring to a height of from 15 to 20 feet. The boiler room was large, and there were few interior points of support available to resist the hydrostatic pressure. It was necessary to build a 7-foot slab to resist most of this pressure by its own dead weight. It was found by tests that the piles exerted an appreciable resistance to uplift. This resistance was not figured in the calculations and was considered only as a factor of safety. Here again no expansion joints are made, and large percentages of temperature steel were used. Steel reinforcement for the basement, the walls and the boiler room amounts to 1,500 tons.

Concrete walls are used up to the level of the main auditorium floor, grade 18.0, and in the headhouse portion to the Boardwalk grade. The superstructure consists of the first, second, third floors and roof of the headhouse, grades 18.0, 36.0, 48.0 and 62.0, respectively, the main auditorium floor, grade 18.0, with side balconies. All curtain side walls are supported by steel columns and spandrels, and the main roof of the auditorium is supported by ten pairs of three-hinged arches. The floors of the headhouse have no special features except for a few trusses which support the main ramps and upper and lower levels of the end balcony of the main auditorium. These trusses were built up of "C. B." sections (Carnegie beams), and this is probably one of the first instances of their use in trusses.

The cast steel pedestals supporting the main auditorium roof trusses rest on 4 x 8-foot concrete piers which are 20 feet high, the tops being 2 feet below the auditorium floor. The ties for the bottom pins of the auditorium trusses form a part of the first floor framing. The truss ties were designed for a 270,000-pound tension plus the bending stress from the dead and live loads of the floor. Particular study of the splices was made by the fabricators of the ties of the trusses because of their excessive length. They furnished sub-punched tie plates at the third points so that they could be adjusted in the field and drilled to fit. These ties in all cases run over the tops of one-story columns to avoid tension in rivet heads. They also furnished ⅛-inch filler plates for connection angles for adjustment in erection in other places. The ties were designed for a low combined stress in order to obtain a low strain. It so happened in the process of construction that the floor steel was completely riveted and the concrete poured before the load of the truss was imposed on the ties. It was found that when the ties assumed the stress of the truss load, movement was experienced at the roller end of the truss; ¼ inch was found to be the maximum.

Leaving the construction of the auditorium for a moment, attention is called to the end walls of the auditorium. The tremendous wind pressure of these end walls was a special problem to meet. On the front walls the vertical columns were supported at the bottom at the grade of the headhouse roof, and the top at the bottom chord of the main auditorium trusses. The bottom reaction of the wall columns was transferred to the row of columns at each end of the ball room of the headhouse by a flat truss in the plane of the headhouse roof, and in turn transmitted by portal bracing to the foundation. The wind pressure of the Pacific Avenue wall of the auditorium was taken care of in a similar manner. Cross bracing instead of portal bracing was used in the row of columns each side of the stage to carry the wind loads down to the foundation. The main auditorium trusses were of a three-hinged type, 334 feet, 3¼ inches pin to pin with a rise of 136 feet, 4½ inches. They had a 7-inch diameter crown pin and an 8½-inch bottom pin. The chord members were of a tee section with an 18-inch stem plate, two 8 x 8 angles, and one or more 18-inch flange plates. The compression web members at alternate panel points where purlins occurred consisted of four angles and two angles at intermediate panel points. Tension web members consisted of two angles. The tee section type of chord worked out very satisfactorily. The use of large gussets was eliminated, and use of secondary stresses was minimized. The general shape of the truss is a curve, and it is made up of a series of straight members chang-



Interior During Construction Showing Movable Scaffolding

ing direction at alternate panel points where splices occur. No abutting compression members were employed, the transmission of stress at all points being done entirely by rivets. One-inch rivets were used at the truss joints and ⅞-inch rivets for bracing connections. Here again particular care was taken by the fabricators in the manufacture of these trusses. All materials of the trusses were sub-punched ¼ inch smaller. Half of each truss was laid on the assembly racks to ordinates of the curvature, bolted together and properly reamed to size. For ten pairs of trusses it is realized that this work involved the setting up and assembly of 40 units.

Referring to the former mention of the end walls of the auditorium, the top support of the wall columns was provided with a sliding connection to the bottom chord of the end trusses. These sliding joints allowed horizontal and vertical movement between the tops of the columns, which were embedded in the brick wall, and the truss chords, which are free to move under varying temperatures. It is to be realized that the trusses, wind bracing and cross bracing between pairs of trusses are independent of all other steel framing and brick walls. At the intersection of the walls and the ceiling soffit of the trusses, joints of copper sheets were installed to allow for movement at these points. The trusses were designed in pairs 10 feet on centers and the pairs 49 feet, 2 inches on centers. Purlin trusses 39 feet, 2 inches long and 3 feet, 6 inches deep are spaced 24 feet on centers and come at every other panel point. Jack rafters, 15-inch I-beams, are framed to the purlins at the third points. Secondary 7-inch channels, 6 feet on centers receive the 3-inch solid gypsum roof slab.

In order to provide lateral support for wind pressure at the upper ends of the columns in the end walls of the auditorium, where the sliding joints occur, two sets of cross bracing in the plane of the upper chords of the trusses were employed in the first and fourth bays at each end of the roof. Each set is destined to take half the wind load of the upper portion of the end wall. It was afterwards deemed advisable to install for erection purposes additional cross bracing in the second bay from each end of the roof, thus obtaining a system of bracing approximately 100 feet in depth for the first three pairs of trusses erected. Wire guys were used and maintained until these first three pairs of trusses were erected and riveted, and the cross bracing 50 per cent riveted. This bracing consists of 6 x 4 angles flush with the plane of the roof and spliced with gussets at the intersections of the jack rafters and the truss chords. The interior bracing in the pairs of trusses consists of one 5 x 3½ x ⅜

angle for tension and two 5 x 3½ x ⅜ angles for compression members. This cross bracing occurred in the horizontal planes of top and bottom chords of the trusses and in vertical planes at every panel point. Six towers were used for the erection of the trusses. Trusses were assembled in place in 24-foot lengths and bracing connected as the work progressed. They were completely riveted to within eight panel points of the crown pin, the remainder being half bolted and half pinned and all the bracing bolted before the erection towers were removed.

The only point of deflection necessary to observe was at the haunch of the truss, at which point there was allowed a clearance between the auditorium wall and the trusses. The deflection of the trusses at the haunch point for the dead load was figured to be, by the method of internal work of distortion, 2 inches. Careful tests were made during the erection of the trusses. Three measurements were taken, first with the weight of the trusses alone, second with the filling-in framing of the roof, and third with the roof covering of 3-inch gypsum. These measurements averaged 1½, 1¾ and 2 inches, respectively, thus indicating that the theoretical deflection checked with the actual.

The heating and ventilating systems, particularly the ventilating of the main auditorium, furnished a problem of unprecedented size. This is indicated by the number and capacity of the fans which it was considered necessary to install, —106 fans supplying a minimum of 746,000 cubic feet of fresh air and exhausting 1,140,000 cubic feet of vitiated air. All the fresh air is heated by indirect heaters having an aggregate surface of about 44,000 square feet. In addition to the indirect heaters, there are 16 window type unit heaters and ventilators for entrance vestibules, and a total of 30,000 square feet of direct radiation.

The ventilation of the auditorium was designed on the basis of upward air movement. In order to understand the arrangement of the apparatus to give this circulation, some features of the design of the building should be known. The roof of the auditorium is supported on ten double trusses spaced 49 feet on centers, each truss consisting of two members on 8-foot centers. These trusses are in the form of three-hinged arches spanning 350 feet and weighing 220 tons to each pair. The trusses rise vertically for about 70 feet before curving toward the center of the building. At this elevation, space was available for fan rooms, and the main supply and vent fans are located here. There is accordingly at each truss on both sides of the building, 70 feet above the street, a double fan room, one part containing a fresh air fan and heaters, and the other an exhaust fan. The fresh air supply is drawn through a circular opening in the outside wall about 75 feet above the street, passing through the indirect heater and into the fan. The fan stands directly over the space between the truss members and discharges vertically downward, utilizing the space in the truss as a duct. At the level of the balcony floor the truss is baffled off and the air diverted into ducts terminating in grilles along the edge of the balcony and along the side wall of the auditorium below the balcony. The supply fans, 16 in number, are of 31,000-c.f.m. capacity, double-width, double-inlet, silentvane type, operating at 382 r.p.m. with 10 h.p. variable speed, remote-control motors and texrope drives. The vent fan in the other part of the truss fan room draws its air from the truss space as does the supply fan, but it extends above the fan room level, in the ceiling of the auditorium.

In the sides of the beams formed by the trusses there are openings, some of which are used for lighting apparatus and others for inlets from the auditorium to the vent duct. The vent fans, 18 in number, are of 40,000-c.f.m. capacity, double-width, double-inlet, multivane type, operating at 162 r.p.m. with 7½ h.p. variable speed, remote-control motors and texrope drives. The vent fans discharge through pent houses on the roof behind the parapet wall. In addition to the main vent fans there are two 5,000-foot propeller fans at the peak of each truss exhausting directly from the top of the room. These fans have constant speed, remote-control motors and are considered an important feature in the proper ventilation of the auditorium, particularly for the summer. Recirculating arrangements are provided for the fresh air fans so that ordinary heating operations will be on an economical basis. These main auditorium supply and vent fans, as here described, constitute the major part of the heating and ventilating equipment. It is of great importance that the ventilation and temperature be properly controlled, because the success of a convention is largely dependent on physical comfort.

The ventilation of the exhibition and garage space in the first story below the main auditorium, presented a considerable problem on account of the large amount of automobile engine exhaust and the relatively low headroom. The data obtained during experiments for the Holland Tunnel were used as the basis for determining suitable quantities of air supply and exhaust. The fan rooms are adjacent to the outside walls. There are two fresh air supply fans with heaters, each fan being of 40,000-c.f.m. capacity, multivane type, double inlet, double width, 206 r.p.m. with 15 h.p. variable speed motor. These two fans are on opposite sides of the room, draw their air from above the marquise, and discharge into

Pouring Concrete Footings over Piles

transverse ceiling ducts connecting in the center of the room to a longitudinal duct which is 40 feet wide by 2 feet deep. It could not be made deeper on account of restrictions of headroom. Outlets into the room are in the bottom of this duct at regular intervals. The exhaust fans are 11 in number, 6 in fan rooms along Mississippi Avenue, and 5 along Georgia Avenue. Each of these fans is a single-inlet, single-width multivane of 12,000-c.f.m. capacity, drawing direct from the side of the exhibition room, through grilles near the floor.

The ball room supply fans are three in number, located in the space above the loggia and discharging into the room through grilles along the edge of the balcony, in the columns along the loggia side, and under the stage. One of these fans is of 25,000-c.f.m. capacity, and the others are of 28,500-c.f.m. each. There are five vent fans each of 15,000-c.f.m. capacity exhausting through 50 small arched openings around the upper part of the room, these openings being provided with pneumatic dampers with remote control. There are also in the ball room about 2,700 square feet of concealed direct radiation.

The boiler plant is located near the Pacific and Georgia Avenue corner, occupying a depressed section of floor, with the pump room and the electrical equipment room. Atlantic City datum is El. 0.0 for mean low water. Mean high water is El. +4.83. The ground floor of the convention hall is El. +2.0, the auditorium floor El. +18.0, and the boiler room El. —15.0. The boiler room extends up through the ground floor to the auditorium floor level, thus having a total height of 33 feet. The excavation for the boiler room is the largest and deepest of any building in Atlantic City, and was protected and kept dry during excavation by a wellpoint system. All concrete below high water level has been waterproofed, and every precaution was taken to prevent any puncturing of the membrane by equipment supports or anchors. Under the boilers, the waterproofing is protected against the heat of the furnaces by hollow tile floor construction, through which air will circulate when the boilers are operating. The anticipated maximum load on the boiler plant is about 3,500 boiler h.p. This load will be reached only a few times a year, and it is planned to carry it as a high overload on the boilers, thus conserving the investment for boilers and boiler equipment. Three water tube boilers have been installed, one of 270 h.p. size and two of 610 h.p. each. The smaller boiler is intended to carry the summer load, providing steam for heating water and other building services. All three boilers at about 225 per cent of rating will carry the winter peak.

Fuel oil is received in tank cars and unloaded by gravity into the storage tanks buried under the platform on the Georgia Avenue side. An excavation has also been made for coal storage in case oil should at any time cease to be available. Oil was chosen as fuel for this building after thorough consideration of its relative costs and advantages as compared to small size anthracite, which is the fuel generally used in Atlantic City. The oil burners are of the steam atomizing type, two burners for the small boiler, and six for each large boiler. They have full automatic control for oil, steam and air flow. The boilers operate at 100 pounds pressure. Feed pumps are duplex,

piston pattern, two size 12 x 8 x 12 and one size 7½ x 5 x 6. The feed water heater is a combination open heater and receiver, having storage capacity for 1,800 gallons of water. The fuel oil pumps are duplex steam pumps with exhaust steam oil heaters. As a starting-up unit an electric pump and electric oil heater are provided. Feed water controllers have been furnished for each boiler, and excess pressure governors for each feed pump. Instruments in the boiler room include fuel oil meters, recording and integrating flow meters, and 2-point draft gauges on each boiler, and feed water thermometer.

Steam Distribution and Control. The steam distribution from the boiler room to the building is accomplished by an 8-inch high pressure steam loop, making the circuit of the entire first story. Each indirect heater for the auditorium has a steam supply connection to this loop, with reducing valve at the heater for 15 pounds' pressure. The unit heater and direct radiator systems are divided into three main groups, each with its reducing valves and low pressure mains. Returns are collected in three pump rooms located as nearly centrally as possible to the group of radiators served. Each pump room contains two motor-driven vacuum pumps and two condensation return pumps. The vacuum pumps discharge into the receivers of the return pumps, which are vented, and these discharge back to the feed water heater at the boiler room.

Temperature Control. A very complete system of temperature control has been provided applying to both the direct and indirect heating systems. Use is made of a method for controlling the main auditorium temperature and for keeping alternate blasts of cold and warm air from the fresh air fans. Eight compound thermostats are provided, two on each side wall, two under the musicians' balcony, and one at each side of the stage. These thermostats control individual and in some cases groups of heaters. In addition to the room thermostats there are provided two-point intermediate acting pilot duct thermostats acting on the diaphragm valves of the fan heaters. During the warming-up period the room thermostats are in control and the duct thermostats inactive. When the hall reaches the desired temperature, the room thermostats act to close the diaphragm valves on the heaters. The control is then automatically referred to the duct thermostats, which by controlling the diaphragm valves prevent the air from dropping below a predetermined air temperature.

Control of the heating and ventilating systems is centralized at two points,—first, the engineers' room, adjacent to the boiler room, controlling the auditorium, garage and other departments in this end of the building, and second, the utility room near the Boardwalk end, controlling the ball room and front portion of the building. The remote control switches on supply and vent fans and the pneumatically controlled dampers are centralized in these rooms. An electrically operated temperature indicating system enables the operator to determine instantly and at any time the temperatures at 117 locations within the building, thus making possible an intelligent manipulation of the control features.

Fire protection equipment consists of automatic sprinklers with hose standpipes and roof nozzles. The primary water supply is the city water system, and the secondary supply a 150,000-gallon reservoir adjacent to pump room and 12,000- and 20,000-gallon elevated sprinkler tanks in the Boardwalk and Pacific Avenue ends of the building. Automatic sprinklers are provided for the entire first story, for all store basements, storerooms, auditorium and ball room, stages, proscenium arches, and dressing and chorus rooms. The static pressure on the city water system is 40 pounds, but the residual pressure is only 15 pounds. Neither of these pressures is sufficient to supply water to the sprinklers in the higher parts of the building, and consequently the automatic fire pump now to be described is necessary to make the primary supply available at these heads. A cast iron main, of partly 8 inches and partly 10 inches, was laid in the streets forming a loop around three sides of the building, and connected to the city mains through check valves at three points.

Two 1,000-gallon Underwriter pumps are located in the pump room near the boiler room and adjacent to the reservoir to which their suction pipes are connected. One pump is a motor-driven, centrifugal unit, and the other a duplex reciprocating pump size 18 x 10 x 12 with an auxiliary pump size 4½ x 2¾ x 4, both with automatic governors. The auxiliary pump operates under control of its governor to maintain full pressure on the system up to the highest sprinklers. If a sprinkler head should open or any flow of water occur beyond the capacity of the auxiliary pump, the main pump will immediately start up, and its 1,000 gallons per minute capacity would be available. The fire pump supply reservoir is kept full by a 6-inch pipe with float valve direct from the city water mains.

The Convention Hall with its equipment was designed by the Architectural and Engineering Departments of Lockwood, Greene & Co., Inc., Walter W. Cook, Chief Architect, and Alexander H. Nelson, of Atlantic City, Associated Engineer.

WALL STREET ENTERS THE BUILDING FIELD

BY

JOHN TAYLOR BOYD, JR.

PART III

IN the new type of building finance, stocks constitute an important feature. Stocks, particularly common stocks, are a much more variable and difficult factor to deal with than bonds, and in order to sell stocks effectively,—and bonds too for that matter,—to the public, a quick, active, and free market, such as only a securities exchange can provide, is necessary. This is one of several reasons that have prompted the Real Estate Board of New York to establish a special exchange for dealing in real estate securities of all types. The term "real estate security" will be broadly interpreted, and will include real estate stocks and bonds of various classes and other securities based on real estate properties or on real estate business, or on the financing of real estate transactions. It is expected that the new exchange will be open for business by October 1, 1929, and earlier if possible. The exchange will be located in the New York Real Estate Board building at 12 East 41st Street, just off Fifth Avenue, where the executive offices of the Real Estate Board are located. There will be 250 seats sold at $5,000 each, with yearly dues of $300 per seat, and it is expected that all seats will be sold before the exchange opens.

These seats have been taken up largely by associates of most of the large real estate offices, and a number have been bought by associates of houses represented on both the New York Stock Exchange and the New York Curb Market, and by individuals connected with various financial, construction, promotion and other interests allied to real estate. A constitution has been drawn up modeled closely on that of the New York Stock Exchange, and the same high standards which that body has established to insure the financial responsibility of brokers and strict honesty in trading, will prevail. A schedule of commissions on sales of securities has been established, of which these charges to non-members are samples: (1) On bonds,—not less than $2 per $1000 par value. (2) On stocks,—a sliding scale, including not less than 7½ cents for stocks selling between $1 and $10; stocks selling between $25 and $50, not less than 15 cents; and not less than 20 cents for stocks selling between $75 and $100, etc.

To the company whose securities are listed, a charge will be made of $100 for each $1,000,000 or portion thereof of each class of security including stock of the par value of $100 per share, or where stock is of a par value less than $100 per share or shares without nominal or par value, $100 for each 10,000 shares or portion thereof. There will be no ticker service. A price board will be maintained on the floor of the exchange, on which will be shown quotations of previous closing prices on securities, last sale, and also the number of the post at which the security is traded in. The brokers' offices will obtain these price quotations by telephoning in to the exchange. The New York Stock Exchange has generously placed at the disposal of the new exchange full information as to its own workings and policies.

Among all these innovations of new finance the establishment of this real estate exchange is the most unusual. Its sponsors feel that not only will it benefit real estate generally, but that in several respects it will become an essential part of real estate and construction finance. It should aid in keeping real estate up to date and in making the necessary adjustments to financial developments since the war. No effort is being spared to make the project a success; it has the backing and good will of powerful real estate and construction interests of New York, and influential men in the New York Real Estate Board are making themselves personally responsible for the success of the undertaking. Architects who are interested in construction finance may find it advisable to watch the success of the real estate exchange. A full understanding of its success requires more than a knowledge of its mechanical function in real estate finance. One should grasp the economic function of a securities exchange in the industry of today.

But why, it may be asked, is a new exchange necessary in New York, where there are already three great general securities markets? Why not use these exchanges in some such manner as was illustrated in the case of the U. S. Realty & Improvement Company and the other real estate companies? The answer is that the exchanges dealing with general securities of New York now deal in such large issues that the average real estate issue, placed on a single building, and of less than $1,000,000 in amount, is too small to be handled by them to the best advantage. There are few companies left on the "big board" with common stock issues of less than 1,000,000 shares. Only a huge corporation, such as the U. S. Realty

& Improvement, which is developing a chain of properties for which it needs constantly millions of fresh capital, can make the best use of the New York Stock Exchange. And we have seen how U. S. Realty, in conjunction with the National City Bank, employed the over-the-counter market to float the issue of approximately $4,000,000 on the Beaux-Arts Apartments building. On the "big board," the common shares of the gigantic Equitable Building on lower Broadway, Manhattan, and the bonds of the similarly large Drake Hotel, of Chicago, stand almost alone.

The Curb Market, likewise, deals chiefly in large issues of expanding companies, generally new issues, many of which, after a process of "seasoning," find their way eventually to the Stock Exchange. We have seen how most of the group of newer real estate development companies herein described, and their construction subsidiaries, have used the Curb Market for their shares. As regards the over-the-counter market, it is true that a rather small number of the largest mortgage bond issues, based on well known huge buildings, have a market there, but even these large issues,—large from the point of view of the building industry,—seem insignificant in size and are easily overlooked by the public. Also, another drawback is that the big Wall Street investment houses are not much interested in an issue of less than $1,000,000. They are organized to handle larger issues, preferably of $10,000,000 or more. The smaller Wall Street houses which will accept the small real estate issue lack the widespread distribution of their large rivals, and their selling costs are likely to be comparatively high. Real estate, therefore, needs its own securities exchange where its smaller issues of $1,000,000 or less will not be dwarfed.

Architects outside New York might consider the possible value to the building industry of the stock exchanges in the other large cities of the country,—Chicago, San Francisco, Los Angeles, Boston, Detroit, Philadelphia, etc. For marketing comparatively small security issues based on local or regional real estate enterprises, these regional securities exchanges might be much more effective than the huge New York general securities markets. They follow the same strict standards as the New York Stock Exchange, and like it, are constantly growing in importance. Though I am not familiar with these exchanges outside New York, it would seem reasonable to suppose that their governing boards would be only too glad to coöperate with the local building industry in encouraging the listing of its securities. Individual building organizations might seek a listing for their issues, or the leaders of the local building industry might consider an approach modeled somewhat on the action of the Real Estate Board of New York in establishing its own exchange. In localities where this does not seem practicable, the leaders of real estate and construction interests, including the architects, might actively sponsor a special section of real estate securities in their local stock exchange.

For it is important to bear in mind that there are grave dangers in introducing to the public a large group of new "unseasoned" securities. A wild speculation, such as took place recently in the new aviation and amusement securities and in various "specialties," is something to avoid if possible. In real estate we have had quite enough of that sort of thing already. Anyone can think of certain nimble gentlemen who would be quick to seize the opportunity offered in the new finance, to unload bushels of worthless paper on the public. The building industry does not want a repetition of the mortgage bond failures of a few years ago. In fact, the sponsors of the New York Real Estate Exchange had just this condition in mind when they decided to create a special real estate exchange. The fullest publicity will be given to the finances of the companies whose securities are traded in, to aid the careful investor in picking out sound securities.

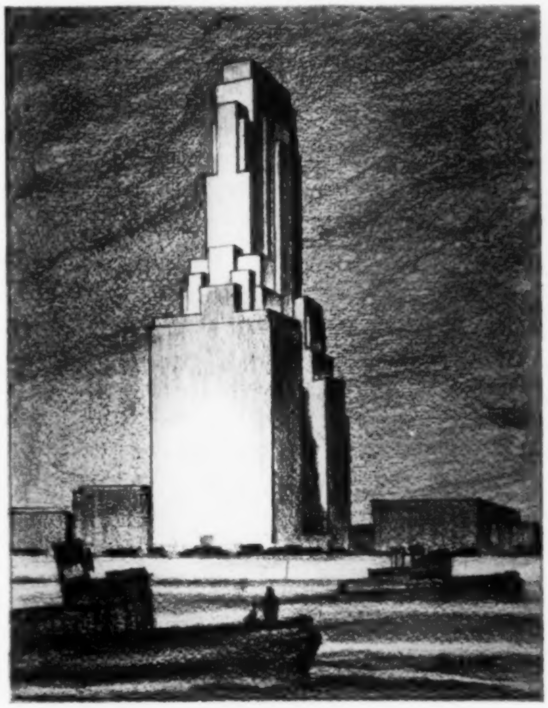
We have seen how the New York Stock Exchange enforces a high standard of publicity as to the finances of the companies whose issues are listed. This is the only means so far devised of protecting the individual investor and of reducing the evils of manipulation of security prices as far as is possible without interfering with a free market. The new real estate exchange will carry this principle even further in one respect,—by subjecting, as a requirement for listing, the real estate properties on which a security is issued to the independent appraisal of the exchange's official appraisal committee. This novel proposal has excited much interest. It does not mean that the exchange will endeavor to fix the price of a security by making public an estimate of the value of the property. That would interfere with a free market, and besides, since appraisal must be in some degree a matter of opinion, there could be no assurance that the exchange's appraisal, however expert, would be 100 per cent correct. What it means is that the exchange will not publish the appraisal but instead will make public the financial statement of the company applying for listing, and will announce that the properties of the company have been appraised by the exchange's committee on appraisal and have been judged suitable for listing. Annual statements of the company's condition will be required, and the company is further obligated to report to the exchange any changes in its financial affairs which will modify the official appraisal. These arrangements will aid the public

to establish fair prices for securities in trading.

Such a standard of complete, periodic and responsible publicity of finances may be painful to certain elements of the building industry, but it is in line with modern financial policy which recognizes that the investor has a right to know what he is buying. Organizations which wish privacy for one or another reason are at liberty to avoid this real estate (or any other) exchange; but it is possible that they will find it increasingly difficult to raise capital in other directions.

The new exchange will follow precedent in taking full precautions to ensure the financial responsibility of the brokers. Its committee on business conduct has the right to investigate the dealings, transactions and financial conditions of members and to examine their books and papers at any time. This right the New York Stock Exchange exercises with greatest severity. Recently it expelled a member because its auditors discovered that he had defrauded the government in filing his income tax return. It was argued that such a man could not be trusted with customers' money. Where transactions are closed by word of mouth,—although "comparisons" of the records are made afterward to ensure accuracy,—the standard of honesty must be absolute for the protection of both brokers and the public. One clear case of crooked dealing or failure to live up to an agreement, and a man is done. As a result of this discipline, the New York Stock Exchange has not had a financial failure among its members in a couple of years,—a record that is not approached even by the banking systems of the country.

Such, in general, are the plans for the new real estate securities exchange, designed to serve the needs of the building industry. Its backers have been considering the project for 14 years, when the idea originated in the desire to free the industry from the grave abuses resulting from extravagant appraisals, this being the chief cause of foreclosures resulting in heavy losses to the public, particularly to those in the "widow and orphan" class, whose patronage the building industry has always sought. These influential New York realtors were alarmed at the disclosure of the conditions attendant upon the crash of a large nationally known mortgage bond house not many years ago, and they resented bitterly the very recent collapse of certain huge buildings,—the financial collapse, of course, because the properties were of the finest architectural standard and were excellently located,—but they could not stand up under the overload of inflated issues.



A Real Estate Exchange Might Market the Securities for a Huge Combination Store, Office Building and Apartment House Such as this Proposed Battery Tower, New York

Thompson & Churchill, Architects

All finance today places great emphasis on the collateral value of a security. In this connection the promoters of the New York Real Estate Board Exchange were somewhat surprised at receiving hundreds of letters from all sections of the country approving their project soon after its announcement. They looked into this aspect and discovered that both bankers and investors were impressed with the need for collateral value in real estate securities, such as only a securities exchange can supply and approve. Suppose, for example, that a man in Tulsa approaches his banker for a loan of $10,000 to build himself a home. He offers as security $15,000 par value of mortgage bonds issued on a big New York office building on Fifth Avenue. But the banker is embarrassed to inform him that the bonds won't do because there is no quick, sure market to sell them in the event the loan turned "sour," and in fact that there is no information available on which to form an opinion as to what the bonds are actually worth. So the bank cannot accept a good business deal, the man can't build a home, and the building industry loses a desirable customer,—all because the real estate bonds have no standing as collateral. This is an illustration of the advantage of establishing collateral value in a security. Today loans made on good stock exchange collateral are coming into favor for financing all sorts of business transactions. Banks favor this type of loan because it is by far the safest,—one of the easiest to make, and one that is satisfactory to the cus-

tomer. This is one reason why many investors favor stock exchange securities.

It may also be said that the sponsors of the real estate exchange are alive to the implications of the new method of construction finance, and the radical changes in economic conditions on which it is based. "The day of the small real estate holding is passed," is a statement they have made on several occasions. "We must take the public into the ownership of real estate. These buildings are getting so large that there is no other way to finance them." A block building proposition becomes a public affair because no one man or syndicate can swing it. Since there are always uses for the small building, the chain principle of ownership may find opportunity in that field, and create another demand for large-scale financing.

This brings us to a brief consideration of the economic function of a stock exchange and its peculiar relationship to common stock issues. Especially is it necessary to form a clear idea of the difference between speculation and investment which will be considered later. This is essential in working out any specific plan of building finance. It is well to avoid becoming involved in the present controversy over the unprecedented speculation on the security exchanges of the nation. The situation seems much too involved for an architect to understand, since some of the greatest financial authorities of the world are at odds over it. For this reason, architects should be on their guard against accepting uncritically the opinion that is now being expressed by some of the financial experts in the building industry to the effect that the money which the building industry needs for mortgages and equities is being diverted to speculation in Wall Street. This diversion, it is argued, will injure the industry.

Without attempting to solve such a knotty problem, it may be worth while to point out that the situation in building finance discussed in these articles throws a different light on the problem. Briefly, we have seen how these new financial-construction organizations, like the Beaux-Arts Development Corporation-U. S. Realty-National City combination have gone into Wall Street, to the Stock Exchange, Curb and over-the-counter markets, and have there obtained their junior mortgage and equity financing much more easily, and what is even more important, they got all the money they wanted and got it on much more economical terms than were offered in the conventional method of building finance. I have not heard any of them complain that Wall Street speculation was strangling their business!

It is apparent that there are many reasons besides the alleged reason of get-rich-quick speculators which makes Wall Street attractive to the public. As previously pointed out, the question of the investor, "What do I get out of it?" gives him control of the situation today. But the matter goes even deeper. The claim is made that one of the controlling factors in the situation is the change of the American nation from a debtor to a creditor nation since the war. We now pile up surplus capital so fast that we must have a new and larger channel to conduct the flow of capital away from the many money tanks which might otherwise clog up and burst. The securities exchange provides a needed safety valve, without which the surplus money might be employed in speculation in commodities, in both urban and farm lands, and in the over-expansion of industries, with disastrous effects to general business. This is about as far as an architect can go. Whatever be the truth to economic theory, there is a very practical point for architects to take note of in the situation. They should note carefully the growth of the security exchanges as a primary source of long-term capital, for no one can deny that long-term capital is what the building industry sorely needs. Nor can one deny the fact that the building industry generally has enjoyed the benefit of low-cost, long-term capital only on first mortgages. It has practically never enjoyed that advantage for junior mortgages and equity financing that other industries have.

This brings us to the distinction between investment and speculation. A delightfully amusing incident took place a few months ago when a prominent New York realtor, long noted for his promotion of sub-divisions, publicly attacked Wall Street for having diverted money from real estate investment into stock speculation! This is the view of a clever salesman, and the man who represents his own goods to be "investments" and the other fellow's goods as "speculations!" But this emotional distinction is not of practical use in working out plans of building finance based on stock issues

Without splitting hairs on economic theory, one may accept, as a good workable definition, the theory that investment means solely the purpose of conserving one's principal, neither adding to it nor subtracting from it, but merely drawing interest thereon by lending it to someone else. Examples of investments are life insurance endowment policies or savings bank accounts or very conservative first mortgages. Only on that basis can one be a pure investor. But the moment that one listens to that little devil Appreciation whispering in one's ear, one becomes corrupted by speculation, and to the extent that one acts on his suggestions, one passes from the 100 per cent of security investment toward the opposite pole of 100 per cent of speculation, which is in the nature of gambling.

On the other hand, it is only too evident that speculation can be excessive, particularly in the highly complex, delicately adjusted economic system of today. One may say that speculation becomes excessive when the evil it works overbalances the good it does as an incentive to business activity. In that case speculation does become harmful, although the problem of how to deal with it practically seems almost insoluble.

Understanding these principles is essential in determining the proper proportions of investment and speculation in working up plans for stock issues. The question is of course one of the amount of risk that seems reasonable in each case. Here one may accept the principle that the value of common stocks in the financial practice of today is likely to rest chiefly on intangibles. Common shares values are based chiefly on earning power and on public confidence in the management and in the competitive strength of the enterprise. For example, General Motors has great earning power and strength, but its "book value" is very low. U. S. Steel is also strong in earning power, but has high book value. On the other hand, most of U. S. Steel's surplus is tied up in highly specialized plants and equipment, and it is likely that, if the management failed to make a success of the steel business, no one could be found who would be willing to take over these plants at 100 cents on the dollar. But with real estate stocks, we have seen that they can have great real liquid book value behind them in the form of fine real estate properties, and this should be a valuable investment advantage in this class of security. The "bonus" stocks, which were discussed in the last article, are very interesting in this connection. When issued they represented nothing but expected appreciation in specific real estate properties; hopes of earning power, and of increasing equity value as mortgages or preferred stock were paid back. On the other hand, as an offset to their speculative character, those bonus shares cost nothing, and are a fairer type of investment than "watered" stocks for which real money is paid.

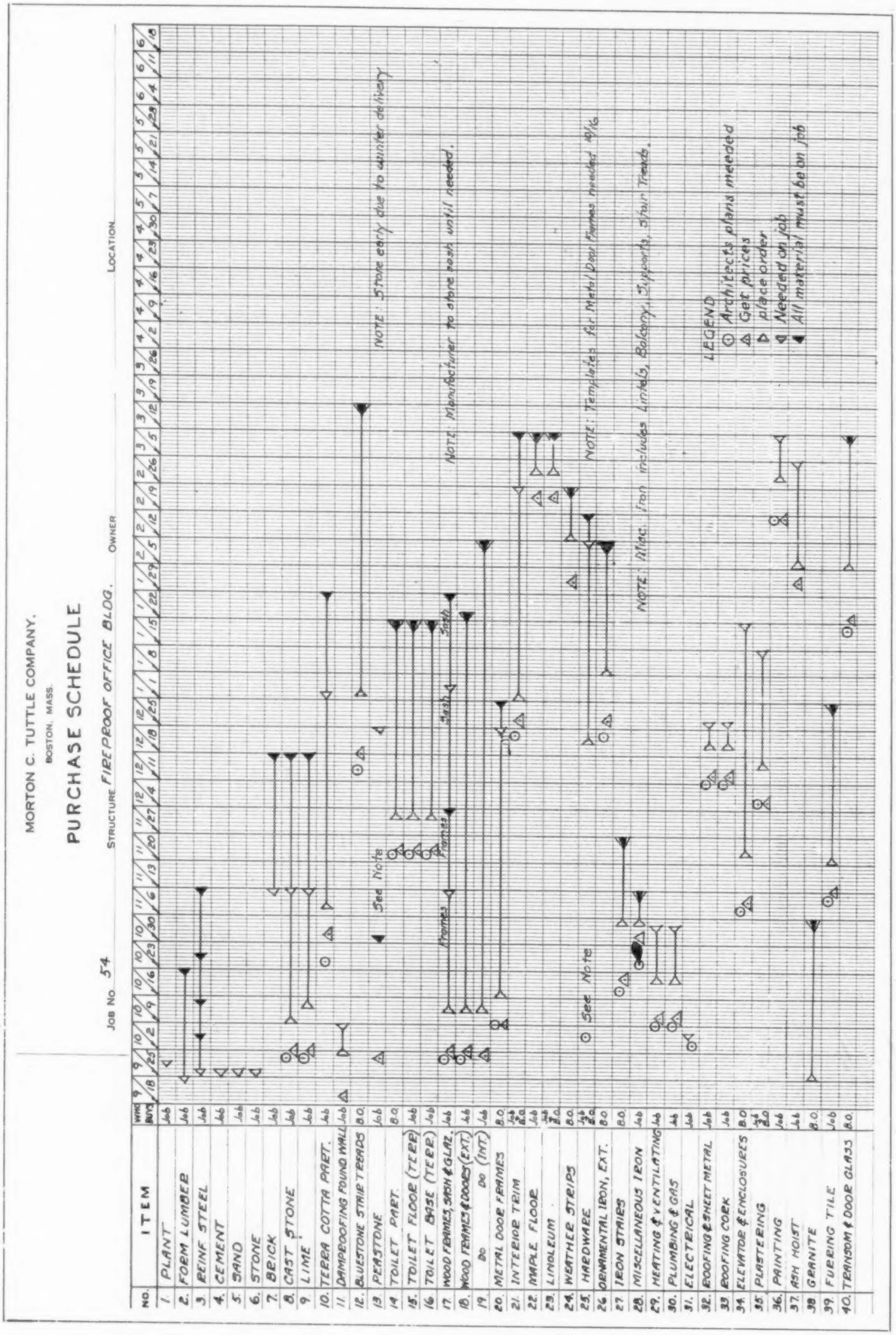
Now, the point of this intangible nature of common stock is that a security exchange provides the only practical yardstick for appraising its values. The prices fixed in the trading represent the consensus of the many different opinions of both public and experts as to the merits of any stock, or in other words, as to the future prospects of the real estate properties on which the stock is issued. Thus in its trading a securities exchange sets a flexible standard for appraising individual stocks and classes of stocks.

This discussion of securities exchanges concludes the account of the new financial developments in the building industry in New York. How different is all this maze of ideas and methods from the good old fashioned plans of building finance! Actually, for years there has been only one plan in building finance. Set the equity and, that done, the choice of two or three possible mortgage alternatives became almost automatic! Such has been the formula for 50 years.

But, from a historical point of view, the placing of junior and equity financing on the basis of long-term security issues seems plausible. It merely completes the transition begun 40 or 50 years ago when the existing elaborate system of first mortgage loans replaced the ancient practices of "private" finance. Up to that time the mortgage and title business rested chiefly in the hands of small individual capitalists, executors of estates, and brokers and lawyers acting for clients. It was costly, inefficient, none too responsible, and was not without its abuses. The needs of the building industry had grown beyond this small scale, uncertain traffic, and accordingly the first mortgage business was organized into a system of public large scale finance, operated by large mortgage and title companies, insurance companies, savings banks and building loan associations, all of which drew funds from the general public for first mortgages in almost unlimited amounts. But since that time nothing has been done for junior and equity financing. Now, after 50 years, that final step may at last be taken. If the movement continues, we may witness further changes in the first mortgage system itself,—possibly greater flexibility and a tendency to obliterate the sharp lines of cleavage which now separate mortgages from equity financing. This latter change was made in the Beaux-Arts financing, as has been described.

The use of security exchanges may become of greater importance in finance. The trend of general finance today is to seek capital from the public as a principal source. Real estate, which has existed more or less as a world apart, with its own peculiar system and customs of finance, may not be able much longer to avoid the change. It may be obliged increasingly to compete with other industries for its share of the surplus capital of the American public in the public securities markets. The Real Estate Board of New York Exchange may prove a valuable aid in making the change.

Such are the possibilities of an interesting and important situation, new and amazingly complex. One sure fact, however, stands out strongly in the uncertainty, like a tower. That is, the crying need of the building industry for the economy of long-term financing of junior mortgages and equities of buildings.



This Controlling Purchase Schedule Is Explained on Page 253

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CONSTRUCTION CONTROL BY SERVICE CONTRACT

BY

L. M. RICHARDSON

MANAGER OF CONSTRUCTION, MORTON C. TUTTLE COMPANY, BOSTON

THERE are three chief points of interest to the man investing in construction,—first, the efficiency of the work as indicated by organization and method of construction; second, the progress in time; and third, the cost of the work. In the case of a contract placed on the basis of price competition, once an award has been made, the method of operation is entirely in the contractor's hands; the matter of time has been specified and is presumed not to concern the owner until the work is completed, and the cost is, as a matter of choice, entirely in the builder's hands. On this latter point an owner buying a building in competition never knows what the work actually costs. On the other hand, where a contract is placed on a service basis and the builder is selected for his particular ability, while the control of the work and responsibility for it are necessarily in the hands of the builder, it is the owner's privilege to interest himself at all times as far as he may wish in following any phase of the construction.

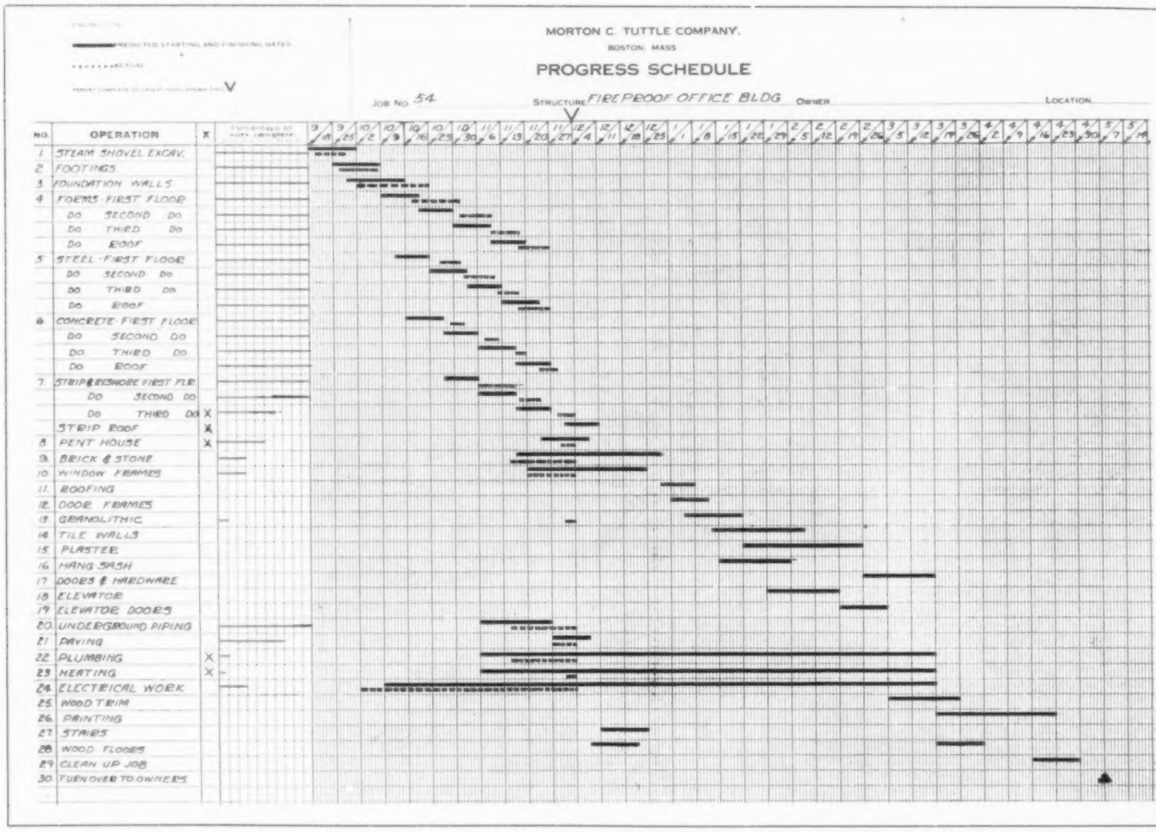
The contractor operating on a service basis naturally counts as his chief asset the good will of his clients, and accordingly he must make every effort to so handle his work that the owner will always find the work proceeding efficiently, with time and cost systematically controlled and periodically recorded. To attain this result, the service builder must pay unusual attention to the selection of his field forces and to the organization of each contract; he must carefully plan the progress of his work to coördinate the various trades, and record progress in such a manner that the time status of the work will at all times be apparent; and, what is of the greatest importance, he must systematically record and follow the cost aspect of the work from every angle to show at all times the actual cost as compared with the original estimate. Because the interests of the owner are paramount in fact as well as in theory, the coöperative aspects of the relation must be carried out in every phase of the operation. The owner's viewpoint must never be lost sight of. Construction procedure, including the systematic recording of cost and progress, must be viewed through his eyes, all records be carried in such manner as to be clear to him rather than in the language of the builder, and a full record in clear, understandable shape always be available to him and to the architect who represents him.

The application of these principles is illustrated in the description here of a construction operation carried out on a service basis. The structure is that referred to in previous articles in THE FORUM, by Morton C. Tuttle (January, 1929), and Clayton W. Mayers of the Morton C. Tuttle Company, Boston (April, 1928), discussing respectively the advantages of collaboration of designer and cost expert and the application of this service in the preliminary stages of a development and prior to starting construction.

The building taken as an example is a fireproof office building, three stories in height, of modified Georgian architecture, with a brick exterior. The entire structural frame of the building is of reinforced concrete with no transverse beams. Reinforced concrete slabs span across the building from side walls to longitudinal beams running lengthwise and located on the lines of the main corridor walls.

Progress Schedule. The basic secret of successful construction may be given almost in a word; it is that of getting the right men and the right materials, in right quantities, at the right place at the right time. *And the essence of all this rightness is time.* Only systematic planning of a building operation before the work starts, including a thorough analysis and careful consideration of each operation involved, can assure completion on a definite, pre-arranged date and guarantee a smoothly coördinated procedure from start to finish. Such planning in the case of the building under discussion is illustrated by the progress schedule produced herewith, showing the time status of the work on November 27, after it had been under way for eleven weeks. This schedule is prepared under the direction of the Manager of Construction from comprehensive records of past experience and is one of the first steps in starting the work, being preceded only by a preliminary survey of local conditions. The schedule is laid out on a printed form with as many columns as there are weeks in the course of the work, each column being headed by the month and day. The original schedule serves as a master sheet and is held in the Company's home office. When completed and finally approved, a number of blue prints are made from it and sent to the field office. Each week the field engineer, whose duty it is to record progress, fills in the schedule up to the current date, and after approval by the field superintendent it is forwarded to the Manager of Construction at the main office. He in turn scrutinizes the schedule and makes such suggestions as field conditions indicate.

Every schedule is based on some one key point, which in this instance was an occupancy date of June 1, desired by the owner. This required the



delivery of the building approximately one month earlier than the final date, to allow the owner sufficient time to install furnishings and make such preliminary preparations as were necessary to assure full occupancy at the desired time. The secondary point in this schedule is November 20, on which date it was desirable to have the concrete frame of the building completed in order to avoid severe weather conditions, with consequent expense, that would undoubtedly be experienced after that date, as the structure is located in northern New England. The schedule was accordingly worked back from November 20, and subsequent operations laid out to show completion on May 1.

It will be noted that this progress schedule lists the various main divisions of the work in the order of construction. These operations are numbered, for convenience of reference, in the first column. Any scheduled item departing more than a day or two from schedule is indicated by a cross in the third column opposite the item. The fourth column is divided to show the percentage of completion of each item and is of particular value as showing at a glance those items which are completed and accordingly require no further attention, and the status of each uncompleted item.

Excavation, the first item in the schedule, was started approximately on time and was completed in slightly less time than had been anticipated. Footings also were completed about as planned. In the case of foundation walls, however, excavation uncovered a more difficult condition than was anticipated, with the result that this item was started three days late, and its completion extended one week beyond the planned time. This naturally delayed the erection of floor forms which, in the case of each floor, were completed about one week later than had been planned. However, because of the desirability of completing the concrete frame as planned, the placing of concrete was accelerated to show completion of each floor in five days rather than the ten days shown, with the result that the concrete roof was in place only two days later than planned.

It is particularly noteworthy that up to this point the progress schedule has served its purpose in indicating each week the exact status of each major operation, and in this case it has shown the steps necessary to bring the work up to time. The removal of forms, covered by Item No. 7, was delayed by the later starting of concrete, but the final removal was not of particular importance once the first story was clear to permit the starting of the brickwork. This brickwork was started on time and was immediately followed by the erection of window frames in order to close in the building as the work progressed. The schedule at

this point shows granolithic work just starting, five weeks ahead of schedule. A reconsideration of this item showed the desirability of making an earlier start, since the completion of this item with the paving would also complete all the concrete work of the building.

This schedule, taken at a later point in the work, would usually show more variation than in the earlier stages, due to the fact that it is more difficult to predict the exact progress of the work of equipment installation, which is usually sub-let, and of interior construction. It is accordingly necessary to pay much closer attention to time during the latter half of an operation than in the earlier stages. A copy of this schedule is sent each week to the owner and to the architect. It is also posted at the field office in order that the full field organization may know the rate of accomplishment.

Purchase Schedule. (See page 250). Progress is directly dependent on delivery of material on definite dates, and accordingly the time of delivery of each major item of material must be pre-determined. To accomplish this a purchase schedule, in form similar to the progress chart on which it is based, is prepared immediately after progress is laid out. The purchase schedule on this particular project is reproduced herewith and is generally self-explanatory. In fixing dates for the delivery of various materials consideration is given to sources of supply and, in the case of subcontractors, to the time required for manufacture or fabrication,—this consideration applying to such items as elevators and enclosures, stairs, doors and windows, etc., which show the dates of placing orders somewhat early as compared with other items. In the third column, after each item, will be noted either the letters "B. O." or the word "Job." This column indicates whether purchase of the particular item is to be made by the Boston office of the Company or by the field office on the job. Where both are shown opposite an item, this indicates that local prices will be taken by the job and figures taken by the Boston office as well. In this particular instance the owner wished all orders placed through his own purchasing department, which accounts for practically all purchases being noted as handled by the job. Regardless of the actual placing of the order, all major purchases are made under the supervision of the general purchasing agent at the main office. This purchase schedule shows the date on which plans must be available if purchases are to be completed as required. Therefore, this schedule, in preliminary form, is presented to the architect for his criticism and suggestion and particularly for his assurance that the dates shown for completion of various plans and detail drawings can be met.

Changes in Estimate. The purpose of an estimate on a building operation is not only to show the probable final cost of the work but to serve as a basis for the recording of costs as the work progresses and the comparison of unit costs with estimated cost as the work proceeds. Although the estimate on which the award of this particular building was made was a close approximation and sufficient to show the amount of the investment involved, it had been based only on preliminary sketches and was not sufficiently accurate to serve as a basis for the field accountant. Accordingly, as soon as plans were sufficiently developed, a revised estimate was prepared and submitted to the architect for his approval, and when approved a copy sent to the owner for his information. In developing this estimate the units used are not general assumptions based on past experience but rather exact unit costs taken from work of a similar character. This is made possible by the operation of the cost accounting system, described here, which makes available in usable form the detailed costs obtained on each contract carried out. Tabulated in simple form, these costs are always available as an up-to-date source of accurate estimating data.

Job Budget. In order that the field forces may be fully informed as to the expected cost accomplishment on the work, the job office is furnished with a budget taken directly from the estimate, but unlike the estimate it is split up into two sections,—labor cost and materials' cost. This budget in preliminary form was made up immediately following the completion of the estimate in order to give a basis for the field cost accounting. As soon as plans were finally completed and the purchases made, a revised budget was prepared which showed numerous changes in various details but little change in the total amount. The total amount shown in labor and material budget is somewhat less than the total of the estimate, since the estimate carries a 5 per cent contingent item which is not shown in the budget. The first column in the labor budget shows the code classification for each item.

JOB BUDGET
for
A FIREPROOF OFFICE BUILDING
IN NEW ENGLAND

LABOR

Excavation		Quantity	@	Total
Das	Clear site (cut trees and dig roots)			$150
Dass	Steam shovel excavation	1,800 c. y.	$0.22	396
Dass-T	Team excavation	1,800 c. y.	.50	900
Dah	General hand excavation behind steam shovel	150 c. y.	.80	120
Dad	Hand excavation for footings, walls and pits	300 c. y.	1.75	525
Ded	Backfill footings and walls	500 c. y.	.75	375
Dap	Level and tamp for paving	6,700 s. f.	.02	134
Deg	General grading 10′ from building			200

(JOB BUDGET, CONTINUED)

	Plant	Quantity	@	Total
Peu	Unload and reload all plant			
Pen	Temporary buildings			
Pes	Sawmill			
Pew	Temporary water, heat and fuel			
Pem	Mixer and motor			
Pel	Tower, boom hoist and motors	(Teams separate)		$1,800
Per	Stagings and runways			
Pess	Steam shovel			
Pe	Misc. other plant			
Pe-T	Team plant			
	Forms			
Fed	Footings (M. E. & S.)	22 sqs.	12.00	264
Fadw	Foundation walls M	80 sqs.	3.50	280
Fedw	and pilasters E	180 sqs.	13.00	2,340
Fidw	and pilasters S	180 sqs.	3.50	630
Feh	Frames at basement windows	No. 52	3.50	182
Facx	Interior and exterior M	46 sqs.	5.30	244
Fecx	columns E	93 sqs.	18.00	1,675
Ficx	S	93 sqs.	2.50	233
Feci	Interior round columns	No. 6	6.00	36
Fafb	Beams and girders M	200 sqs.	3.50	700
Fefb	slab E	348 sqs.	12.00	4,180
Fifb	S	348 sqs.	1.50	522
Fep	Concrete platform MES	2½ sqs.	18.00	45
Fes	Stairs and landings and steps	68 l. f.	.50	34
Ful	Unload and handle lumber	400 M	2.00	200
	Steel Reinforcement			
Ref	Cut, bend and place all slab and beam steel	62 tons	25.00	1,550
Rec	Cut, bend and place all column steel	10 tons	26.00	260
Rez	Cut, bend and place all foundation wall, footing and misc. steel	22 tons	35.00	770
Ru	Steel reinforcement unloading and sorting	94 tons	2.00	188
Ru-T	Team all steel reinforcement	94 tons	....	75
	Concrete			
Med	Footings	78 c. y.	1.80	141
Medw	Foundation walls, pilasters and areaways	244 c. y.	2.25	548
Mep	Paving	84 c. y.	1.80	151
Mez	Platform	5 c. y.	2.50	13
Mes	Steps, landings	68 l. f.	.30	20
Mef	Slabs, beams, girders and columns	700 c. y.	2.00	1,400
Kuaf	Granolithic finish (laid after)	258 sqs.	8.00	2,070
Kub	Sanitary base in toilet rooms	482 l. f.	30	145
Kof	Float finish	12 sqs.	3.00	36
Kiw 1	Patch and rub exterior concrete	19 sqs,	....	300
Kiw 2	Sundry carbo. rub in parts of basement left unplastered		....	300
Mo	Cut fins and fill voids on concrete ceilings painted	....	....	400
Mux	Unload and handle cement	2,450 bbls.	.14	343
Mux-T	Team cement	2,450 bbls.	.14	343
Muyz	Trim sand and gravel pile	2,570 tons	.06	155
Mecc	Cinder concrete fill	18 c. y.	5.00	90
Mu	Unload peastone and team to job	98 tons	.75	74
	Masonry			
Bew	Stage, tend and lay all brickwork	8,090 c. f.	.90	7,280
Bet	Terra cotta tile partitions, 4" and 6"	17,895 s. f.	.12	2,150
Bewc	Clean down brick and stone	130 sqs.	4.00	520
Bec	Set all granite (imitation)	3,135 c. f.	1.00	3,135
Bef	Flue, etc., including fire brick and panels at front entrance of brick	....	....	400
Bu-T	Team brick, tile, lime and stone	....	....	400
Bu	Unload and handle all brick, tile, lime and imitation granite	....	....	450
Beg	Set granite at front entrance and other door sills	300 c. f.	....	300
	Steel and Iron			
Sedf	Set door frames Single	No. 83	5.00	415
	Double (Hollow metal)	No. 5	7.00	35
Sedfm	Set steel channel frames	No. 2	5.00	10
Sed	Set metal covered and steel doors	No. 2	....	50
Sel	Set steel lintels and column cores	....	....	300
Sez	Miscellaneous iron and steel, including steel sash	40 sqs.	....	300
Su	Handle all miscellaneous iron	40 sqs.		
	Carpentry			
Cedf	Set wood door frames	No. 8	7.00	56
Ced	Set all wood doors, Front Entrance	No. 1	....	1,140
	Double	No. 12	20.00	1,140
	Single	No. 85	10.00	1,140
	W. C. doors	No. 20	2.00	1,140
Cewf	Set window frames	No. 215	4.00	860
Cet	All interior trim and exterior millwork	....	....	2,000
Ces	Set wood sash and glass	4,437 s. f.	....	2,000
Cet	Maple top floor	20 sqs.	8.00	160
Cesc	2x4 screeds, treated, set in concrete	1,500 l. f.	....	160
Cesf	7/8" sub-floor and paper	2½ M		
Cez	Miscellaneous carpentry work including louvers and ceiling over portico	....	....	200

	Other Trades	Quantity	@	Total
Gewp	Waterproof labor on foundation walls and other exterior walls	....	....	$150
Sch	Scheduling and job expediting	....	....	200
Zor	Clean up job, team away rubbish and clean glass at completion	....	....	500
Zarp	Engineering on lot and building lines	....	....	150
Zsc	Attendance on sub-contractors	....	....	400
M	Cold weather expense	....	....	2,500
W	Watchman	....	....	750
O	Overhead	....	....	4,200
	TOTAL LABOR AND TEAMS			$56,748

MATERIALS AND SUB-CONTRACTS

Plant	Quantity	@	Total
Small tools (less salvage)			
Supplies (used up no salvage)			
Power, fuel, water, light and temporary connections			
Teaming and freight charge on small tools, supplies and large plant			
Rental and repairs of large plant			$5,000
1. Excavation			
2. Concrete			
3. Forms and carpentry			
4. Masonry			
5. Reinforcement			
6. Miscellaneous			
Carpentry Materials			
Form lumber 100 M at 40.00	4,000		
Salvage	300	....	3,700
Nails, oils, bolts and hangers for form lumber and sheeting	....	....	600
Sheeting lumber	3 M	$40.00	120
Screeds	1,600 l. f.	....	175
7/8" sub-floor	3 M	40.00	120
Top floor	3 M	100.00	300
All interior trim and millwork	....	....	3,000
Wood sash and glass and frames	4,337 s. f.	.85	3,680
Wood doors (Single)	No. 85	....	1,100
Wood doors (Double)	No. 12		
Wood door frames	No. 8	....	50
Steel and Iron			
Metal column forms	No. 6	....	225
Steel reinforcement	94 tons	56.00	5,270
Wire sundries for reinforcement	....	....	300
Structural steel lintels	905 l. f.	....	500
Door frames (metal) (Single)	No. 83	....	1,050
Door frames (metal) (Double)	No. 7		
Miscellaneous iron and steel	....	....	500
Hardware for entire job	....	....	1,800
Column cores and base plates and caps	No. 6	....	450
Metal doors tin clad and steel	No. 2	....	100
Concrete and Masonry Materials			
Cement 2,450 bbls. at 3.05	7,480	....	....
Credit on bags returned 2,450 bbls. .40	980	....	6,500
Cement tests	2,450 bbls.	.03	74
Loss on empties	2,450 bbls.	.05	123
Sand	1,050 tons	1.25	1,315
Gravel	1,420 tons	2.25	3,190
Peastone	98 tons	6.00	588
Lime for mortar	25 tons	20.00	500
Common brick	154 M	17.50	2,700
Fire brick and flue lining	....	....	250
Imitation granite	3,135 c. f.	....	10,000
Terra cotta tile 4"	17,895 s. f.	.09	1,610
Granite steps and thresholds	....	....	1,600
General and Miscellaneous Materials			
Test boring	....	....	535
Brick anchors and ties	....	....	200
Building paper for floors and miscellaneous	....	....	300
Waterproofing	....	....	320
Sub-Contracts			
1. (a) Roofing, flashing, conductor heads	1,400	....	2,500
(b) Cork insulation	1,100		
2. W. C. partitions, marble and doors	No. 19	....	1,700
3. Ceramic floors in toilets and bases	....	....	1,200
4. Linoleum 3/16" in special offices	....	....	400
5. Metal lath and plaster for entire job, including hung ceilings and cement base (approximately 7,800 s. y.)	....	....	9,200
6. Painting for entire job	....	....	5,200
7. Weather strips for sash	....	....	700
8. City connections to sewers, for gas, water, etc	....	....	250
9. Ash hoist in place	....	....	250
10. Iron stairs and W. I. rail and ornamental iron	....	....	3,000
11. Bluestone treads for stairs	....	....	500
12. Elevator doors and frame	No. 4	....	700
13. Travertine floor and base at main entrance	63 l. f.	....	400
Cold weather expense	....	....	3,000
Expediting expenses	....	....	350
Liability insurance (fire insurance by owner)	....	....	2,000
Superintendence, travel, office, stationery, telephone	....	....	6,000
TOTAL MATERIALS AND SUB-CONTRACTS			$95,195

(JOB BUDGET, CONTINUED)

Equipment	Quant'ty	Total
1. Heating, boilers and stack	15,000	
2. Plumbing, conductors, drains and sewers	7,500	
3. Gas piping	350	
4. Elevator (freight of 2 tons, slow speed)	2,300	
5. Electric work and wiring (no fixtures included) elevator wiring	4,500	$29,650
LABOR		56,748
TOTAL LABOR, MATERIALS AND SUB-CONTRACTS AND EQUIPMENT		$179,593

Items not included:

1. Roads, sidewalks, general planting, auto space, landscape work.
2. Removing old buildings.
3. Wood top floors except in Assembly Hall.
4. Color for granolithic floors.
5. Screens for windows and doors.
6. Rock, ledge or quicksand or running water in excavation.
7. Lighting fixtures, telephones, furniture or rugs.
8. Window shades.
9. Fireplaces.

Timekeeping. The timekeeping code in use by this Company is based on the "mnemonic" system. The first letter of the code item is a consonant indicating the general classification; D for excavation or digging, P for plant, F for forms, B for brickwork, etc. The second letter is a vowel indicating the kind of labor; that is, a for making, e for placing, i for removing, etc. The third letter or combinations of third and fourth letters are consonants indicating the part of the building to which the item applies. These last letters have different meanings in some different classifications, but as far as possible are confined to one kind of work; that is, d would apply to footings whether in connection with excavation, forms, concrete or reinforcement; c would apply to columns in every case; and f would always mean floors, etc.

This code is used primarily for recording at definite times through each day the exact work on which each man on the job is engaged. The time sheet on which this record is made is divided into columns, each representing one hour of the day, while a vertical column at the left shows the number by which each individual on the job is known. In recording the time the timekeeper simply notes opposite a man's number and in the proper hourly column the code classification of the work on which the man is engaged. This time sheet is summarized each day by collecting all of the charges under each code classification. Incidentally, the total number of hours of each man's labor is transferred to the payroll sheet.

Although the various labor charges are summarized in finished form only once each week, it will be obvious that it is a simple matter to check up, whenever desired, what a single day's costs are on a given item. For instance, it is frequently desired to know what the day's cost is on concrete or brickwork, the quantity measurement of which is a simple matter. Accordingly, an hour's work on the time sheet will summarize the particular item so that the actual cost of a day's work is easily shown the early part of the following day, and opportunity is given to correct any irregularity that may be shown by the figures.

Labor Statement. Daily labor costs are transferred to a summary sheet which is completed once each week and transferred to a form called the labor statement. This form follows exactly the items as laid out in the labor budget. The labor statement reproduced herewith is taken at the end of the eleventh week of the work. It will be noted that it shows the week's cost, that it compares the actual cost with estimated cost in both total expense and units and, what is of the greatest importance, it indicates what the final cost of each item will be if completed at the going rate of accomplishment. Too much emphasis cannot be placed on the value of this particular point. It will be obvious that a cost system which shows costs only at the completion of a contract is of value only to the contractor in estimating future work and is of no use whatever during construction as offering an opportunity to correct unsatisfactory conditions. It will also be obvious that if, in the labor statement shown, the expenditure on each item were given without reference to the uncompleted remainder, it might well indicate a false condition. For instance, certain items involving a limited amount of work might show a saving totaling some hundreds of dollars, whereas one of the larger items, of which only a small part of the total had been completed, might show an over-run in actual expenditure far less than the total of savings on other items. Therefore, considered as an independent statement, the weekly report would show the job to have saved money, yet on the large item which is over-running (if the rate of over-run were to continue through the life of the job), the final extra expense might far more than offset any savings on smaller items.

This labor statement is forwarded each week by the field superintendent to the Manager of Construction at the main office, who immediately interests himself in any items which may be out of proportion, and in consultation with the field superintendent he gives particular attention to the items in question with a view to correcting them *while the work is still under way.*

Material Statement. A material statement similar in form to the labor statement is also based on the job budget. Because this material statement is largely a record of purchases and does not offer the opportunity for correcting conditions as does the labor portion of the work, it is compiled only once each month. It does, however, carry out the same idea as the labor statement in showing in its final columns the probable standing of the cost of material *at the end of the work.* It will be noted that actual quantities vary in many cases from estimated quantities, and that there is also frequent variation between both esti-

Form 5-9-28

Morton C. Tuttle Company

Job 54 For Fire Proof Office Bldg... At Sheet No. 1

LABOR STATEMENT THRU November 27 1926 11th WEEK, OF 33 SCHEDULED

Symbol	ITEM	Week's Cost	Week's Unit	Unit of Meas.	Quantity Estimated Total	Quantity Actual Total To Date	Unit Estimated	Unit Actual	Cost Estimated Total	Cost Actual To Date	Probable Final	To Date Saving	To Date Overrun	Probable Final Saving	Probable Final Overrun
	-EXCAVATION-														
Das	Clear Site			$	150				150		35			115	
Dass	Steam shovel excavation			cy	1800	1800	.22	.191	396		345			51	
" T	Team above			"	1800	1800	.50	.284	900		510			390	
Dah	General hand excavation			"	150	$79	.80		120		120				
Dad	Footings, walls and pits			"	300	150	1.75	1.69	525		254			271	
Ded	Backfill ftgs. and walls			"	500	265	.75	.735	375		366			9	
Dap	Level and tamp for paving	39.31		sf	6700	2000	.02	.019	134		127			7	
									2600		1757			843	
	-PLANT-														
Peu	Unload and reload plant					$265									
Pen	Temporary buildings	5.29				$261									
Pes	Sawmill					$ 29									
Pew	Temp. water, heat, fuel			$	1800	$ 11			1800		1800				
Pem	Mixer and motor	5.35				$109									
Pel	Tower, hoist and boom	17.50				$410									
Per	Stagings and runways	15.48				$ 52									
Pess	Steam shovel					$ 14									
Pe	Misc. plant					$ 22									
									1800		1800				
	-FORMS-														
Fed	Footings M.E.S.			sqs	22	15	12.	7.02	264		105			159	
Facw	Fdtn walls, pilasters Make			$	280				280		63			217	
Fedw	" " " Erect			sqs	180	110	13.	11.19	2340		1500			840	
Fidw	" " " Strip	12.01		"	180	106	3.50	2.40	630		432			198	
Feh	Frames at bs'm't windows			#	52	52	3.50	2.60	182		135			47	
Facx	Int. and Ext. columns Make			$	244	$286			244		350				106
Fecx	" " " " Erect	297.72		sqs	93	85	18.	16.19	1675		1506			169	
Ficx	" " " " Strip	23.37		"	93	61	2.50	2.53	233		235			2	
Fafb	Slab, beams, girders Make	24.87		"	200	153	3.50	4.40	700		880			180	
Fefb	" " " Erect	595.65		"	348	337	12.	8.47	4180		3000			1180	
Fifb	" " " Strip	97.42		"	348	160	1.50	2.92	522		1016				494
Feci	Interior round columns			#	6	6	6.	7.64	36		46				10
Ful	Unload form lumber			M	100	102	2.00	.921	200		100			100	
											9362			2916	792
									11486						

Form 5-9-28

Morton C. Tuttle Company

Job 54 For Fire Proof Office Bldg. At Sheet No. 2

LABOR STATEMENT THRU November 27 1926 11th WEEK, OF 33 SCHEDULED

Symbol	ITEM	Week's Cost	Week's Unit	Unit of Meas.	Quantity Estimated Total	Quantity Actual Total To Date	Unit Estimated	Unit Actual	Cost Estimated Total	Cost Actual To Date	Probable Final	To Date Saving	To Date Overrun	Probable Final Saving	Probable Final Overrun
	-REINFORCEMENT-														
Ref	Slab and beam steel	145.45		T	62	54.5	25.	14.14	1550		877			673	
Rec	Column steel	54.77		T	10	15.33	26.	14.64	260		225			35	
Rez	Fdtn. walls, ftgs, misc.	$		T.	22	12.9	35.	18.88	770		415			355	
Ru	Unload steel			T	94	85.123	2.	1.26	188		108			80	
" T	Team above			$	75				75					75	
									2843		1625			1218	
	-CONCRETE-														
Med	Footings			cy	78	83	1.80	1.89	141		157				16
Medw	Fdtn. walls, pilasters, etc.	23.14		"	244	243	2.25	2.11	548		515			33	
Mep	Paving	44.97		"	84	24	1.80	1.87	151		157				6
Mef	Slab, beams, cols, girders	125.58		"	700	643	2.00	1.48	1400		1036			364	
Kuaf	Grano. finish (laid after)	4.75		sqs	258	$39	8.00		2070		2070				
Kiw1	Patch&rub ext. concrete	26.05		$	300	$189			300		300				
Kiw2	Rub parts of bmst unplastered			$	300	$ 42			300		300				
Mux	Unload and hdle. cement	8.62		bbls	2450	2170	.14	.099	343		245			98	
Muyz	Trim sand and stone pile	61.38		$	155	$276			155		400				245
Mu	Unload pea stone			T	98	97.15	.75	1.38	74		135				61
									5482		5315			495	329
	-MASONRY-														
Bew	Stage, tend, lay brick work	431.85		cf	8090	656	.90	.80	7280		6472			808	
Bec	Set imitation granite	208.96		cf	3135	295	1.	1.21	3135		3793				658
Bu	Unload brick tile, lime, etc.	16.50		$	450	$109			450		450				
Beg	Set granite	71.14		cf	300	66	1.	1.08	300		308				8
									11165		11023			808	666
	-MISC. IRON-														
Sedf	Set door frames, sgle & dble			$	450	$ 4			450		450				
Sel	Set steel lintels			$	300	$40			300		300				
Sez	Misc. iron & unload			$	300	$ 6			300		300				
									1050		1050				
	-CARPENTRY-														
Cewf	Set window frames	61.	4.06	#	215	15	4.	4.06	860						
Cesf	7/8" Sub floor & paper	7.43		$	160	$ 7			160		873				13
Ces$_c$	2x4 Screed treated										160				
									1020		1033				13

Facsimiles of Labor Statement Sheets, Omitting the Ruling, in Light Blue and Red, of the Originals

Form 5-9-28

Morton C. Tuttle Company

Job 54 For Fire Proof Office Bldg. At Sheet No. 3

LABOR STATEMENT THRU November 27 1926 11th WEEK, OF 33 SCHEDULED

Symbol	ITEM	Week's Cost	Week's Unit	Unit of Meas.	Quantity Estimated Total	Quantity Actual Total To Date	Unit Estimated	Unit Actual	Cost Estimated Total	Cost Actual To Date	Cost Probable Final	To Date Saving	To Date Overrun	Probable Final Saving	Probable Final Overrun
Gewp	Water proofing			$	150	$19			150		150				
Sch	Scheduling & job expediting			$	200	57			200		100			100	
Zarp	Engineering on lot & bldg lines			$	150				150		55			95	
Z sc	Attend sub contractors	13.44		$	400	$32			400		400				
Mh	Cold weather expense	196.62		$	2500	$799			2500		3000				500
W	Watchman	24.		$	750	$272			750		750				
O	Overhead	92.50		$	4200	$820			4200		3700			500	—
	SAVING $4676.00								45796		41120			5189	513

-EXTRAS-

X 1 Labor to bring sewer, water gas, electric lights and telephone from Green St. to new building 1.00 $266

X 5 Labor necessary to construct retaining wall along driveway at north side of building $16.09 $ 16

X 6 Labor necessary to form additional concrete slab on roof to pitch roof 36.92 $ 37

-CONTRA CHARGES-

Work for Owner $ 12

-COST TO DATE-

Labor	Truck	Total
$17498.82	$510	$18008.82

Labor Statement, Continued

mated and actual unit costs and between estimated and actual total costs. The last columns, however, show that various savings more than offset over-runs, and that on the material side of the work there is at this point a substantial margin.

Cost Tendency Chart. In order to more quickly and clearly indicate the condition of the work as regards labor costs, it is a practice in this Company to plot each weekly labor statement on a cost tendency or "lightning" chart. This

Morton C. Tuttle Company

Job 54 For Fire Proof Office Bldg. At Statement No. 3

MATERIAL STATEMENT TO December 11th 1926 Sheet No. 1

ITEM		Quantity Est.	Quantity Actual	Unit Est.	Unit Act.	Cost Est. Total	Cost Actual To Date	Estimated Additional Expenditure	Est. Final Cost	Saving	Overrun
-PLANT-											
Small tools							1476	300	1776		
Supplies used up							205	55	260		
Power, fuel, water, light and temp. connections							183	150	333		
Teaming and freight							764	200	964		
Lumber for runs, staging and temporary buildings	$						1024	26	1050		1355
Rentals & rep. Excav'n	P1	5000				5000	525		525		
" " Conc.	"						360	200	560		
" " Form	"						121	80	201		
" " Masonry	"										
" " Rein.	"										
" " Misc.	"						286	800	1086		
Probable salvage on plant						400					
						5400	4944	1811	6755		
Form lumber	M	100	102.31	37	39.20	3700	4012		4012		312
Nails, oils, bolts, hangers	$	600				600	529	50	579	21	
						4300	4541	50	4591		291
Sheeting lumber	M	3		40		120				120	
Screeds kyanized	Lf	1600	1600			175		60	60	115	
7/8" sub floor	M	3		40		120		120	120		
Top floor	M	3		100		300		300	300		
All interior trim, millwork	$	3000				3000		3000	3000		
Wood sash, glass & frames	$	3680				3680		3278	3278	402	
Wood doors, sgle & dble	$	1100				1100		1100	1100		
Wood door frames	$	50				50		50	50		
Metal column forms	$	225				225	222		222	3	
Steel reinforcement	T	94	85.123	56	53.30	5270	4336	200	4536	734	
Wire sundries for steel	$	300				300	110	50	160	140	
						5570	4446	250	4696	874	
Structural steel lintels	$	500				500	219		219	281	
Door frames (metal) sgle & dble		1050				1050	33	1017	1050		
Misc. iron & steel	$	500				500	63	455	518		18
Hose for entire job	$	1800				1800		2000	2000		200
Col. cores, base plates	$	450				450	401		401	49	

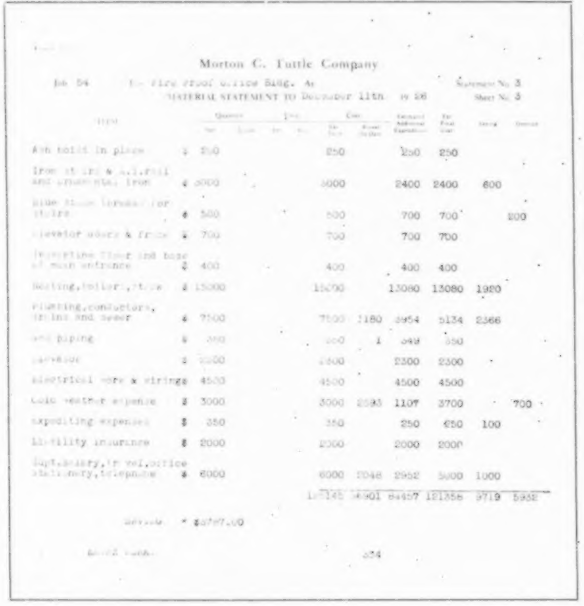
Morton C. Tuttle Company

Job 54 For Fire Proof Office Bldg. At Statement No. 3

MATERIAL STATEMENT TO December 11th 1926 Sheet No. 2

ITEM		Quantity Est.	Quantity Actual	Unit Est.	Unit Act.	Cost Est. Total	Cost Actual To Date	Estimated Additional Expenditure	Est. Final Cost	Saving	Overrun
Metal doors, tin clad & steel		100				100		100	100		
Cement	bbls	2450	2762	2.65	2.66	6500	7381		7381		881
" tests	"	2450	2762	.03	.02	74	63	6	69	5	
Loss on empties	"	2450		.05		123		123	123		
						6697	7444	129	7573		876
Sand	T	1050	700cy 70cy	1.25	1.50 1.75	1315	1037	136	1173	142	
Stone	T	1420	975cy	2.25	3	3190	2888	37	2925	265	
Pea stone	T	98	97.15	6	7.21	588	713		713		115
Lime for mortar	T	25	8.4	20	22.88	500	196		196	304	
Common brick	M	154	154	17.50	17.50	2700	1068	1632	2700		
Fire brick & flue lining	$	250				250		210	210	40	
Imitation granitegranite		11600				11600	1750	8836	10586	1014	
Terra cotta tile 4"	sf	17895	17920	.09	.088	1610		1586	1586	24	
Test borings	$	535				535	535		535		
Brick anchors & ties	$	200				200	28	72	100	100	
Building paper for floors		300				300		300	300		
Waterproofing	$	320				320	312	225	537		217
Roofing, flashing, conductor heads, cork insulation	$	2500				2500	119	4161	4300		1800
T.C. partitions, marble and doors	$	1700				1700		1700	1700		
Ceramic floors in toilets and bases	$	1200				1200		1200	1200		
Linoleum 3/16" in special offices	$	400				400		400	400		
Metal lath and plaster for entire job	$	9200				9200		9200	9200		
Painting for entire job	$	5200				5200		5200	5200		
Weather strips for sash	$	700				700		850	850		150
City connection to sewer for gas, water, etc.	$	[illegible]				120	120	120	[illegible]		

Material Statements for a Fireproof Office Building



Morton C. Tuttle Company

Job 54 — Fire Proof Office Bldg. At — Statement No. 3
MATERIAL STATEMENT TO December 11th 19 26 — Sheet No. 3

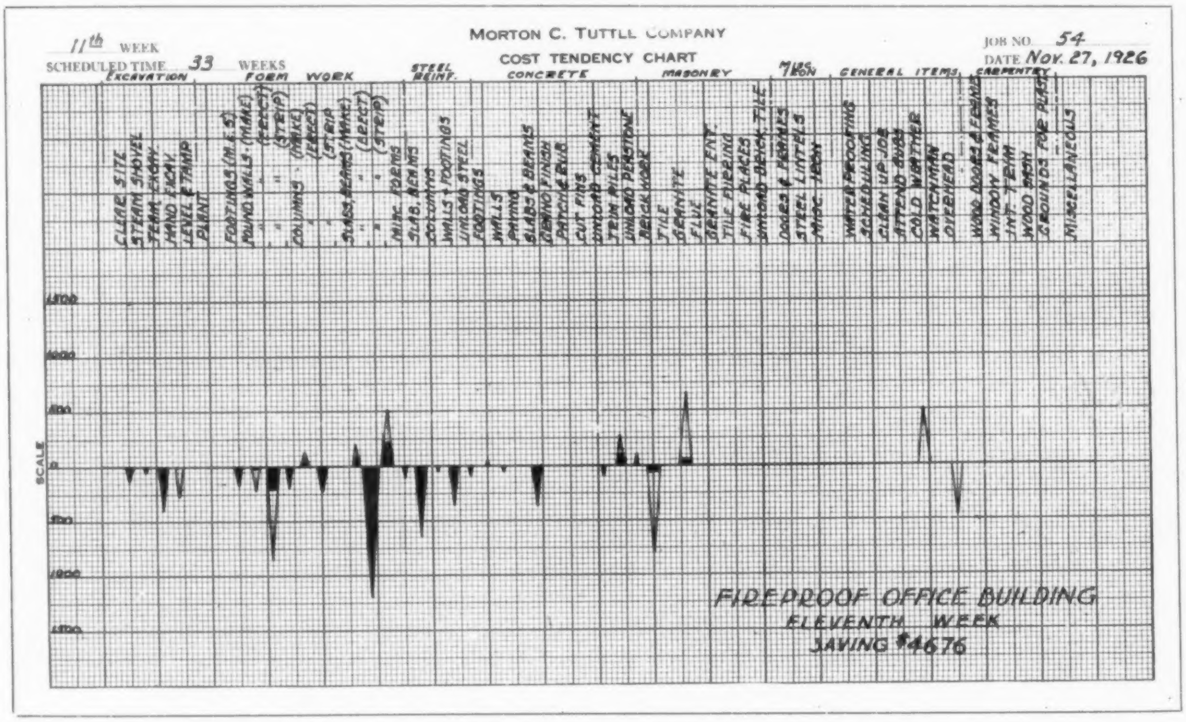
Ash hoist in place	$ 250	250		250	250		
Iron stairs & [illegible] rail and ornamental iron	$ 3000	3000		2400	2400	600	
Blue stone treads for stairs	$ 500	500		700	700		200
Elevator doors & frames	$ 700	700		700	700		
Travertine floor and base at main entrance	$ 400	400		400	400		
Heating, boilers, [illegible]	$ 15000	15000		13080	13080	1920	
Plumbing, conductors, drains and sewer	$ 7500	7500	2180	2954	5134	2366	
Gas piping	$ 350	350	1	349	350		
Hardware	$ 2300	2300		2300	2300		
Electrical work & wirings	4500	4500		4500	4500		
Cold weather expense	$ 3000	3000	2593	1107	3700		700
Expediting expenses	$ 350	350		250	250	100	
Liability insurance	$ 2000	2000		2000	2000		
Supt. salary, travel, office stationery, telephone	$ 6000	6000	2048	2952	5000	1000	
		[illegible]	36901	84457	121356	9719	5932

Saving = $3787.00

chart, covering the work at the end of the eleventh week is reproduced herewith and will be generally self-explanatory. By reference to the chart it is immediately apparent just which items are showing greatest deviation from the budget.

Like the labor and material statements, the principal emphasis in this chart is on the *probable final cost of the work* rather than the total expenditure to date. Therefore the high points of the variations are the points which would show *at the end of the work* if the going rate of accomplishment were continued. The amount of saving is the indicated saving *at the end of the work* rather than at the time the chart is plotted. Copies of this cost tendency chart are sent each week to the architect and to the owner, thus keeping them informed in detail as the work proceeds.

Extra Work. The method of caring for additions and changes under the service type of contract as compared with the usual agreement made on the basis of competitive bids is interesting. In the latter case the contractor generally names a lump sum for each item, and there is usually little opportunity for architect or owner to question the amount. Under a service type of contract, however, the architect or owner is given an estimate in detail showing exactly what each addition or change involves. When an extra item is authorized it is simply carried along and accounted for in the same way as the rest of the work under a number assigned to it. In this way the owner pays the exact cost of labor and material plus the contractor's fee, which is usually a pre-determined percentage of cost. A periodic statement of all extras is compiled and given to architect and owner in order that these costs may be added to the weekly labor and material statements to show the total probable final cost. It is, therefore, obvious that on the service basis there is no opportunity for making arbitrary demands in connection with extra work, and that one major source of discord is in this way eliminated.



The Cost Tendency Chart is an Important Factor in Cost Control

THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 8. FORM WORK

SPECIFICATIONS for form work for the school building under discussion read:

FORMS:—

"(A) IN GENERAL. The Contractor shall provide all required wood (or other) forms for the proper execution of all concrete work, plain and reinforced, and supplied in sufficient quantity so that the work can be prosecuted with despatch. Removable steel forms of No. 16 gauge metal, of approved design, may be used where appropriate for floor slabs, at option of Contractor.

"(B) STRENGTH of all forms shall be sufficient to carry the dead load of materials and construction operations without deflection or vibration. They shall be so braced as to be rigid under trucking and other action incidental to building. They shall be so designed as to be capable of needed adjustments, shall be carefully watched as work proceeds, and all faults promptly corrected.

"(C) SMOOTHNESS. Surfaces of forms in contact with concrete, intended to remain exposed, shall be of dressed lumber with tight joints, so built as to provide, after removal, a true, smooth finished concrete. Members and surfaces shall be straight and true to line; walls, columns and piers absolutely perpendicular, and all horizontal members free from the slightest sag. Perfect finish will not be required on those surfaces exposed in unfinished rooms, in basement, or in ducts, or those elsewhere which are to be concealed by subsequent construction. All surfaces shall, however, be true to planes and profiles detailed.

"(D) INSPECTION. Ample opportunity shall be given the Superintendent to examine all forms just before concrete is poured. They shall then be thoroughly clean, free from shavings, tags, dirt or other rubbish, and shall be thoroughly drenched, except in freezing weather. Forms for vertical construction shall have openings at bottom, until ready for pouring, to permit removal of rubbish and dirt.

"(E) WRECKING OF FORMS shall not be started for 7 days after pouring, and none shall be done until the Superintendent gives consent and then only at the sole risk of the Contractor. After wrecking, sufficient struts shall remain to insure rigidity and strength until final set."

So far as the interest of the architect or engineer is concerned, forms (or centering) are in the same category as other equipment of the builder's,—merely tools of his trade intended to produce certain desired results at minimum expense. It is the contractor's business to determine—

(1) Of what material the forms shall be constructed.

(2) How they shall be put together.

(3) How they shall be braced and secured.

(4) That they are clean at time of pouring, and drenched, oiled or soaped as called for.

(5) What means are to be provided for easy wrecking, with least damage.

(6) That wrecking is not done too soon and that sufficient struts are left.

The superintendent must see—

(1) That the form material is such that it will produce true surfaces of the intended texture.

(2) That forms are built to the exact dimensions of the finished work.

(3) That all bracing is adequate.

(4) That all surfaces are in proper condition at the time of pouring.

(5) That wrecking of forms is done in such manner as not to injure the concrete.

(6) That wrecking is not done too soon, and that sufficient temporary supports are left.

Form lumber is often the first material delivered, and carpenters are at once set to work to prepare it to be placed. As to this material, the superintendent's main concern is that it is of a character to produce the desired finished surfaces. Second hand material should not be used for forms for finished surfaces, owing to its lack of uniformity. There is an increasing tendency among architects to build finished concrete surfaces on which all form marks are plainly visible, and the marks of the grain of rough lumber. This is frankly monolithic concrete, without any rubbing or coating whatever. Others require the surfaces to be rubbed, treated with grout or by means of a cement gun. For the former effect, one must see that no form member is of a character to mar the intended finish. But, if the surfaces are to be rubbed, coated, plastered or veneered, then a lesser degree of perfection of form surface is necessary. In any event, form lumber should be medium dry and free from loose or large knots. Kiln-dried lumber is too absorbent, and green lumber is too likely to shrink and cause leaks and ridges.

The builder may construct his basement wall forms of separate boards or planks or of sections previously built up and intended to be interchangeable. Such sections are sometimes taken from job to job and can be used six or eight

times, whereas separate boards can seldom be used more than two or three times,—frequently only once.

By referring to Fig. 8, it is to be noted that, in this work, forms were required for the upper portions of footings, the lower portions of which were deposited within earth banks; 2 x 6-inch members were used for these footing forms, which were held in place by driven stakes and, later, easily removed. After the footings were partially set and the waterproof course in place, work on wall forms proceeded at once, progressing in both directions from the southeast corner.

The superintendent carefully verified all dimensions and saw that the form work was rigidly braced, especially at the bottom, where the weight of the fluid mass exerts greatest pressure. Weak forms are said to "constitute one of the four principal causes to which have been attributed the failures in some concrete buildings. These causes are (1) imperfect design, (2) poor materials, (3) faulty construction and (4) weak forms."* Especially must the superintendent see that forms made of ⅞-inch boards are erected with more frequent ribbing than if 1¾-inch plank is employed. For the former, the ribs or studs cannot exceed 2 feet on centers with safety, while those for plank can be double the distance, except that, where the depth of forms exceeds 12 feet, it may be found necessary to decrease the spacing in either instance, in order to prevent "bulging" and the consequent "wavy" surface in the concrete.

The experienced superintendent will be in no way officious in his inspection and criticism of form work. He is particular to impress upon the foreman the latter's full responsibility for everything pertaining to the forms. The superintendent's coöperation in this regard is advisory only, and hence he must avoid assuming any liability,—as is ever the case where he is privileged and expected to call attention to defects in working methods and implements, but he should give approval to naught but satisfactory results. This point in the performance of a superintendent or inspector cannot be too thoroughly stressed. His assumption of undue authority may at times involve him in serious trouble, as has already been explained in these articles.

Where basement wall forms extend to the under side of the first floor slab, as is frequently the case, due regard must be had for window and door openings and for pockets for beam and girder bearings, flue openings and the like. Builders of forms are accustomed to look upon it as the roughest of work, and hence often need the closest watching in the matter of dimensions and the insertion of minor built-in mouldings and other members. The foreman should be impressed with the importance of these and be compelled to work to a fraction of an inch in order that all carelessness may be eliminated at the start instead of being permitted to become a habit. He can easily be made to see how much more simple it is to correct form work than to chop out concrete. This is especially true of surfaces that are to be paneled or otherwise enriched. Members must not only conform exactly to detail but must be so secured as not to be sprung out of place by rodding. The continuity of such members forming belt courses, rustication, etc., is of the utmost importance to a design, and hence they must be aligned and secured with the greatest accuracy and rigidity.

The superintendent on our school building also impressed upon the foreman the need of his being advised well in advance of the starting of pouring at any point. It is most convenient for a foreman to assume that the inspector is as fully informed as himself regarding all job conditions; but there are dozens of things about the premises demanding attention, any of which a conscientious inspector might be watching just when pouring is about to begin somewhere else. He must be advised in time to see that forms are in final condition, as set forth in the specifications under the head of "Inspection." Such inspection should not be made a half day, nor even an hour ahead of the pouring, but immediately before the first deposit is made. A superintendent must bear in mind that everything within the forms is in "temporary suspension" until embedded, easily jarred or kicked out of place, and that "foreign substance" is possessed of peculiar attraction for place in forms; that even the forms themselves are temporary in character and are the recipients of no respect from workmen. Again is "eternal vigilance the price of safety." It is one of the many times when a superintendent feels that he cannot turn his back for a moment but must apply the closest scrutiny to everything that is to be covered. The only foreign substances allowed to remain in the forms are the ties and spreaders. The former will be built in and cut off later, but the wooden spreaders must be fished out as the rodding proceeds. Workmen are sometimes careless about removing all of these, and they must be cautioned. It is serious work to cut them out of finished concrete.

Inspection of floor forms is no different from that of wall forms, except that special attention is to be paid to measurements of beam and girder work, making sure of proper thicknesses and alignment, and overseeing the method of installing supports. If any one of the several proprie-

* Page 611 in F. E. Kidder's "Building Construction and Superintendence."

tary systems of concrete floor construction is used, the superintendent should be supplied with detailed drawings and specifications in order to make sure that the workmen know what they are doing and are performing the work correctly.

Notwithstanding that the specifications place upon the contractor the entire responsibility for premature removal of forms, it is well for the architect and superintendent to have a working knowledge of what is considered good practice in this regard. Here is an excerpt from a consensus of opinion of several contractors whose expressions on the subject were combined and published by the Atlas Portland Cement Co.: "As a guide to practice these rules are suggested: Walls in mass work: one to three days, or until the concrete will bear the pressure of the thumb without indentation. Thin walls: in summer, two days; in cold weather, five days. Slabs up to 6 feet span: in summer, six days; in cold weather, two weeks. Beams and girders and long span slabs: in summer, ten days or two weeks; in cold weather, from three weeks to one month. If shores are left without disturbing them, the time of removal of the sheeting in summer may be reduced to one week. Column forms: in summer, two days; in cold weather, four days, provided girders are shored to prevent appreciable weight weakening columns. Conduits: two or three days, provided there is not a heavy fill upon them. Arches: of small size, one week; for large arches with heavy dead load, one month. A very important exception to these rules applies to concrete which has been frozen after placing, or has been maintained at a temperature just above freezing. In such cases the forms must be left in place until after warm weather comes, and then until the concrete has thoroughly dried out and hardened."

From this it will be seen that the question of the length of time that must elapse after pouring before forms can be removed depends much upon the service they are performing, and it is likewise a matter of judgment of the experienced concrete worker, it being borne in mind always that in the desire of a contractor to hasten the work and at the same time economize on form lumber, there is a constant temptation to wreck the forms a day or so too soon. Many floor failures have resulted from shortsightedness, and hence a superintendent should see that the contractor "plays safe."

THE SUPERVISION OF CONSTRUCTION OPERATIONS

CHAPTER 9

CONCRETE WORK

SPECIFICATIONS for cement and aggregates were quoted in a preceding chapter. As is customary, the superintendent in charge of construction of the schoolhouse being considered here gave early attention to the brand of cement to be used and to the character of aggregates delivered. Strictly speaking, the passing upon these materials is presumed to be based upon laboratory reports, and hence is not a function of the superintendent. However, inasmuch as the sand and crushed stone generally used are of kinds and grades easily judged by visual inspection, laboratory tests are frequently confined to the cement, even on work of importance. For the work under discussion, the contractor proposed using pit-run gravel for his plain concrete, adding the amount of sand or coarse aggregate that might be needed to make it conform to the specifications. For reinforced work, he was to screen out all stones larger than ¾-inch.

It is not expected that a superintendent will decide what kind of concrete will be used in any location. All questions of design are predetermined. He is at the site to see that they are properly carried out, to know that what is produced is fully up to specification requirements. To be able to assert that this has been accomplished, he must know:

(1) That the aggregates are
  (a) of proper kind,
  (b) sufficiently clean,
  (c) of correct size and shape,
  (d) well graded,
  (e) of adequate hardness,
  (f) of due moisture content;

(2) that the proportions are such as to produce the maximum density of each type called for;

(3) that the cement is fresh, up to test standards, and used in correct ratio;

(4) that all ingredients are properly mixed;

(5) that the completed mixture is
  (a) deposited promptly, without separation of ingredients,
  (b) adequately agitated,
  (c) undisturbed after setting begins,
  (d) properly bonded to previous work,
  (e) deposited only against surfaces in proper condition to receive it,
  (f) properly protected until final setting is complete.

Treating of these matters in the order enumerated, the superintendent gave his attention to the aggregates, while awaiting reports on the samples sent in for testing.

(1-a) *Kinds of Aggregates.* Our specification called for broken stone or gravel for the coarse

aggregate, and sand for the fine, with a provision for the use of pit-run material. Crushed furnace slag is often specified in localities where it is procurable, and in some districts pulverized stone is used in place of sand. Crushed brick or tile may also be used for coarse aggregate, if of adequate hardness, of proper size, and free from dust. Cinders are used by many architects and engineers and are permitted in reinforced floor slab construction by certain building codes, notably that of New York. Other codes (as that of Chicago) permit the use of cinder concrete for fireproofing of steel members, but limit its workable compressive strength to 700 pounds per square inch. They also require that metal pipe embedded in cinder concrete shall first be coated with a cement grout. A typical specification for cinders for concrete reads:

"CINDERS shall be clean, hard, steam-boiler coal cinders, crushed to range in size from ¼- to ¾-inch (or 1-inch), and free from unburned coal or other substance injurious to concrete or its reinforcement."

Probably no building material is the subject of more controversy than cinders, principally because there is so much variation in them, and because it is impossible to make conditions for testing identical with those maintaining in all structures. The "personal element" in concrete construction stands out stronger with use of this aggregate than with use of any other. If cinders are specified, they must conform in general to requirements for other aggregate, the main variant being that of the substances in their composition, other than unburned coal, which would be "injurious to concrete or its reinforcement." Some writers mention sulphur in this category, but the prejudice against presence of that chemical appears to be unfounded. Perhaps the whole gist of the subject can best be summed up by quoting Professor C. L. Norton of the Massachusetts Institute of Technology: "Sulphur might (cause corrosion) if present, were it not for the presence of the strongly alkaline cement; but with that present the corrosion of steel by the sulphur of cinders in a sound Portland concrete is the veriest myth, and as a matter of fact the ordinary cinders, classed as steam cinders, contain only a very small amount of sulphur. There is one cure (for the rusting of steel in cinder concrete) and only one,—to mix wet and mix well. With this precaution, I would trust cinder concrete quite as quickly as stone concrete in the matter of corrosion."*

(1-b) *Cleanliness of Aggregates.* With the recent vast increase in the annual output of cement products, the preparation and handling of aggregates have become so commercialized that, even in rural communities, one generally finds them properly prepared for market by due grading and washing. The coarser material usually offered is crushed rock,—granite, trap rock, boulders, sandstone or limestone. Any of the first three will be clean if not in contact with earth nor stored too long. Sandstone or limestone will probably be covered by their own dust to such an extent as to need washing, and should be admitted only on that condition, assuming them to be otherwise acceptable. Sand and gravel, on the other hand, may be offered just as taken from the pit, hence must be carefully inspected. Up to a few years ago, concrete experts were accustomed to demand that sand and gravel must be close to 100 per cent clean, and one still encounters specifications containing this requirement. More recent authorities, however, have satisfied themselves that a small amount of clay, even up to 8 per cent of the volume of the sand, is not injurious and may even be beneficial.* But, in the use of both sand and gravel, one must be sure that a permissible silt content containing clay and sand doesn't also carry loam, organic matter, or oily substances.** Such material is not "clean," and will not make good concrete and should be washed. Some specifications stipulate that "the volume (of foreign substance) removed by decantation shall not exceed 3 per cent of the weight."*** While decantation means properly a laboratory test, it can also be performed in the field in a crude way by giving the aggregates a thorough washing and rinsing; pouring the dirty water into a vessel and allowing it to settle; then pouring off the clear water, and drying and weighing the residue; then comparing that weight with that of the bulk from which the dirt was removed. Some specifications stipulate that such objectionable matter shall not exceed 2 per cent, but the judgment of engineering committees permits the larger quantity. Care as to cleanliness of ingredients must be continued until they are actually incorporated in the work, and hence specifications require that all aggregates shall be deposited on plank floors or paving. If dumped on the ground, there will be "foreign substance" shoveled into the barrows or mixer in spite of all precautions. Water should also be clean, and this is generally so specified: "WATER for concrete shall be clean and free from in-

* Report No. 9 Insurance Experiment Station, Boston Manfrs. Mut. Fire Ins. Co. in Kidder's "Architects' and Builders' Pocket-Book," page 882e.

* "Reinforced Concrete and Masonry Construction," Hool & Kinne, page 4.

** These are subjects for laboratory tests; see pages 726 and 727 in Hool & Kinne's "Reinforced Concrete and Masonry Structures."

*** "Tentative Specifications for Concrete and Reinforced Concrete" by the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete of the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, American Concrete Institute and the Portland Cement Association.

jurious amounts of oil, acid, alkali, organic matter or other objectionable content." Ordinary drinking (potable) water is always fit for the purpose, as is rain water that has not picked up too much improper admixture from surfaces with which it has been in contact. Any water under suspicion should be sent to the laboratory for analysis.

(1-c). *Size and Shape of Aggregates.* Specifications for broken stone (crushed rock) and gravel call for a range in size from ¼- or ⅜-inch up to ¾- or 1-inch for reinforced work, and up to 1-inch, 1½ inches or 2 inches for plain, mass or rough concrete.* Some specifications, notably for bridge,** and railway work (and including that we are using), permit the embedding of large pebbles or stone weighing up to 100 pounds in mass concrete, under certain restrictions. The superintendent can readily adjudge the sizes of the aggregates, since minor variations are unimportant. When it was customary to specify the maximum size as that of a piece that would pass through a ring of given diameter, grading screens were perforated sheets with holes to comply. But this refinement is being abandoned, and use of the "ring" specifications is disappearing. Screens of square wire mesh are now in as common use as those with round holes.

Insistence upon sharpness or angularity of aggregate has been customary from the time when concrete was mortar with coarse aggregate added, the former made with hydraulic or other cement which adhered to angular or rough surfaces better than to those that were round or smooth. Fractures of concrete made of gravel and Portland cement, however, disclose cleavages through round pebbles, rather than around them; hence "sharpness" of aggregate is no longer demanded. The one objectionable shape of aggregate is the thin and laminated. The presence of many of these will seriously cut down efficiency, especially in reinforced work.

(1-d). *Aggregates to be Well Graded.* This is insisted upon in both sand and coarse aggregate, and is essential to density. If one were to attempt to make concrete with a single size of coarse aggregate and a single size of sand, it would take too much sand to fill the interstices for economical construction. Even "grading" means that all interstices will be filled by largest size pieces, from coarsest to finest. Graded sand for the purpose (sometimes termed "torpedo" sand) should conform to this specification: "SAND shall range in size from fine to coarse, and the percentage of weight of sand retained when passing through standard screens shall be at least 100 per cent on a No. 100 sieve, 80 per cent on a No. 50, 25 per cent on a No. 40, 10 per cent on a No. 20 and none on a No. 10."

These proportions are varied somewhat by different authorities* but will be found generally practicable as given. Finer sand will make good concrete (though quite unsuitable for mortar), but it demands an undue amount of cement.

(1-e). *Aggregates to be of Adequate Hardness.* If doubt exists as to the hardness of the aggregates, samples should be sent to the laboratory. Ordinarily, granite and gravel pebbles are safe enough; limestone and sandstone are open to doubt, but "no type of aggregate such as granite, gravel or limestone can be said to be generally superior to all other types. There are good and poor aggregates of each type."**

(1-f). *Aggregates to Have Due Moisture Content.* The ratio of water in aggregates, prior to their being put in the mixer, is of less import than that the moisture content shall be known and that the water added shall be proportioned accordingly. It is always well to use a hose on the material in the pile just before using, both to carry off the dust and, in the case of porous stone, slag, brick, tile or cinders, to prevent the later absorption of too much thin cement.

(2). *Proportions to be Such as to Produce the Maximum Density of Each Type Called For.* The ratios of concrete ingredients most commonly used are 1:1½:3 or 1:2:4 for reinforced work and 1:2½:5 or 1:3:6 for plain or non-reinforced. The workable compressive strengths of variously composed concretes (other than cinder concrete) are from 1,500 to 3,000 pounds per square inch, dependent upon the ratios of cement and fine and coarse aggregate, the moisture content, the excellence of the mix, and the thoroughness of the compacting.*** Unfortunately, the "personal element" in the making of concrete is its most outstanding characteristic. It is easy to make good concrete, but still easier to use careless methods and produce inferior work; hence one reason

* Some specifications refer by number to commercial sizes of aggregates which are rated thus:—
No. 1 crushed rock, graded up to that which passes a 3-inch sieve.
No. 2 do., graded from a 1-inch sieve up to a 2-inch sieve.
No. 3 do., graded from a No. 4 sieve up to a 1-inch sieve.
No. 4 do., graded from a No. 16 sieve up to a No. 3 sieve.
(All sizes assumed to be standard meshes.)

** "In large masses of concrete one-man stones may be employed, provided that they first be cleaned and wetted thoroughly, and provided that they be not placed any nearer than six (6) inches to each other or to the exterior of the construction." Dr. J. A. L. Waddell in "Bridge Engineering," page 1852.

* See pages 6 to 11 of "Reinforced Concrete and Masonry Construction," Hool & Kinne.

** Technology Paper 58, U. S. Bureau of Standards.

*** See the "Progress Report of the New Joint Committee on Standard Specifications for Concrete and Reinforced Concrete," Appendix F in Hool & Kinne's "Reinforced Concrete and Masonry Structures."

for the unduly large number of failures in this construction. From the ratios here given, it is seen to be a general assumption that it takes about half as much sand as coarse aggregate in order to fill the voids in the latter. Such being the case, it is apparently inconsistent to name 1:2:4 and 1:3:5 in the same specification, as is done in some localities,—notably in Chicago. Obviously, if 1:2:4 is correct for a rich concrete, then a 1.3:6 mix with similar materials will produce cheaper concrete than 1:3:5 and of equal strength.

The main task for the superintendent is to assure himself that the ratios fixed in the specifications will produce concrete of maximum density with the materials at hand. As to this, the specifications say:

"VARIATIONS. The proportions given for the various kinds of concrete are based upon the use of well graded aggregates, as specified. In case the aggregates are not so graded, the Architect may change the proportion of cement to fine aggregate, without changing the proportion of cement to coarse aggregate and without additional compensation to the Contractor. No gravel (pit-run or other) shall be used until the Architect has had opportunity to test same and to determine what additional coarse or fine aggregate is to be added to such gravel, or if any addition is necessary. The Contractor shall conform to such demands to produce concrete of maximum density and shall not permit a change in the character of aggregates delivered at the site without due notice to the Superintendent and revised instructions as to procedure."

The indeterminate feature of this, insofar as pit-run material is concerned, is that there is no positive statement as to the proportion of such aggregate that will be the equivalent of what is specified. There seldom is, in any specification, and so there exists a cause for argument that could as well be eliminated. It should be clear enough, since one purpose of using the finer material is the filling of voids in the coarser aggregate, so that, if ratios are correctly specified, the bulk of the mix will only slightly exceed that of the coarse aggregate, and hence a 1:3:6 ratio becomes 1:6, if the aggregates are delivered ready mixed. Nevertheless, a young inspector may be surprised to find the contractor and all his mechanics insisting that a 1:3:6 mix is equivalent to 1:9, with pit-run material. Being faced by more experienced men, the novice may be much embarrassed in his contention, if he finds nothing specific in the contract documents on the subject and can lay his hand on no other authority to back him up. The truth is that not enough attention is ordinarily given to obtaining precisely correct proportions of aggregates, except for very important work.*

On this subject, the Portland Cement Association, in its publication, "Concrete Data for Engineers and Architects," says; "A 1:3:5 nominal mix does not give a 1:8 true mix as sometimes assumed, but about a 1:7 true mix." This means that the "true mix" should be computed at 40 per cent more than the bulk of the coarse aggregate, whereas the author's contention is that it should be only about 10 per cent additional, that is, 1:5½. Supporting the Association's statement, their authority, Prof. D. A. Abrams, says further: "As a matter of fact, instead of filling the voids, a coarser particle in fine aggregate will actually separate the particles of coarse aggregate farther than they would be normally. This is the reason it is necessary to use a considerable portion of sand, more than the theoretical amount required to fill voids. In any section of concrete which has been cut, one will note that in general aggregate particles are floating in a cement-water mixture. It is for this reason that the cement-water ratio becomes of controlling importance. Within the usual range of quantities, the volume of mixing aggregate will be about 85 per cent of the total volume of the fine and coarse aggregate." From which it will be seen that the ideal and surest way of stating the desired amount of cement would be to give its ratio per cubic foot of finished concrete; then to use the cement-water ratio for ascertaining desirable percentages of aggregates and moisture.

Given his design and proportions, the superintendent must know that the materials to hand are such as will properly "fill the bill." He can measure the voids in the coarse aggregate by filling a vessel with a known quantity, then pouring in enough measured water to fill to the same level. The amount of sand used should be slightly in excess of the quantity of water. In other words, if half as much sand as coarse aggregate is called for, then it is assumed that the voids in the latter are about 45 or 48 per cent of its bulk. Voids in the sand can be measured the same way and should run 25 to 40 per cent. Measurements should be by weight, and the water should be weighed before being poured in, since capillarity will prevent its all being drawn off. To ascertain roughly whether or not pit-run material contains a proper grading of all the aggregates, it is necessary to separate the fine and coarse by screen with a ¼-inch mesh sieve, then measuring the quantities of the two sizes and the voids in the larger, in the manner just described here.

* For proper proportions of concrete ingredients, see "Concrete, Plain and Reinforced," Taylor & Thompson, Hool & Johnson, F. E. Kidder and other standard authorities; including "Design and Control of Concrete Mixtures," published by the Portland Cement Association, Third Edition, January, 1929.

(To be continued)